# POLAR EQUILIBRIUM, Tianjin Jan/2010

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## Contents; 目录；

1. *Review SuDBE2009 Chongqing October 2009 Presentation*
1. 回顾2009年10月“建筑与环境可持续发展”会议（重庆）的演讲
2. *Development of the Binder-Schmidt and Crust Formation Models*
2. “Binder-Schmidt”模型和“地表构成”模型
3. *Tutorials on Selected Topics and Computational Methodology*
3. 选题指南和计算的方法

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## Contents; 目录；

4. *Introduction to SYNCOOL, Rainforests and Micro-forestation*
4.介绍“光和冷却”、“热带雨林”和“微观造林”。
5. *Introduction to SCIF, SCIF-CAP, Polar-Inversion and the G-Factor*
5.介绍标准建造影响因素、标准建造影响交易、两极倒置和G因子
6. *Research and Consultation Projects incl. GRAPHITE-GLOBE©*
6.研究和磋商方案包括“石墨地球”

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## 1. The Chongqing PolarEquilibrium Overview;

*Go to Chongqing presentation …..*

1. 重庆会议报告概述


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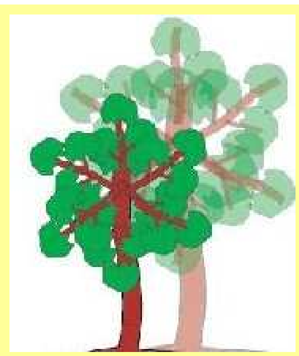
## 2. SYNCOOL and SCIF Overview;

*Photosynthesis Cooling*

2. 光和冷却和标准建造影响因素概述



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***SYNCOOL*** *is an acronym for "photosynthesis" cooling. SYNCOOL constitutes a major global equilibrium force via the conversion of solar radiation into biomass. Atmospheric CO2 is an essential element in the conversion of solar radiation into biomass. Because photosynthesis effectively removes a component of the incident solar radiation, SYNCOOL // rainforests acts as a global air conditioner.*

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***SYNCOOL Computational Model;***

*20ft/20y: 12inch diameter x 20ft =12cubFT =1,200lb*

*10ft diameter canopy = 60SF =1,200/60/20 =1lb/SF pa*

*1lb =12,000Btu =12,000/360/12 =3Btu/SF/h (daylight)*

*14cubFT =1lb air; 1lb air x 1F =0.25Btu*

*20ft air x 3Btu = 2.5/0.25 =10F*

***SYNCOOL =10F***

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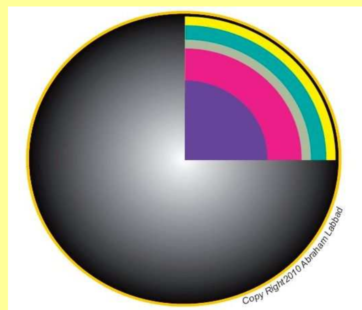
***3. Selected Topics;***

*The Beginning; Polar Inversion; Deep Space Radiation; Graphite-Globe*




3. 选题；

起源；两极倒置；

深空辐射；石墨地球

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## BEGINNING (iii)

**Ek/m =0.5xMxV^2 (Joules/mol)**

**V =10,000m/sec (Earth escape velocity)**
**M =56 (Iron/Fe) grams (90% E-mass)**
**Qf =14 (fusion) kJ/mol**
**Qv =340 (boiling) kJ/mol**
**Cp =25 (heat capacity) J/mol**

**Ti = 1,538C(fusion); Tii =2,862C (boiling)**

**Tiii =28x10^8/10^3/25/56 =7,143C(hypo)**

**Tii =2,862C // 5,642R (boiling/controls)**

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## *BEGINNING (iii)*

***Ek/m=0.5xMxV^2(焦/摩尔)动能)***

**V =10,000米/秒 (地球的逃逸速度)**
**M =56 (铁) 克 (90% 地球重量)**
**Qf =14 (融化) 千焦/摩尔)**
**Qv =340 (沸腾) 千焦/摩尔**
**Cp =25 (热容) 焦/摩尔**

**Ti = 1,538摄氏度(融化); Tii =2,862摄氏度 (沸腾)**

**Tiii =28x10^8/10^3/25/56 =7,143摄氏度(假设)**

**Tii =2,862摄氏度// 5,642兰氏度 (沸腾/控制)**

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## ***Polar Inversion // Crust heat flux;***

*Gradient =792R-495R =297F*

*Slab thickness =25miles =132,000ft*

*Thermal conductivity =2Btu/SF/degF/h*

*1q =k x dt/dx =2 x 297/132,000 =0.0045 Btu/SF/hour*

*2q =q x 365 x 24 =0.0045 x 8760 =39.42Btu/SF for one year*

*3q =2q x 1000 =39.42 x 1000 =39,420 Btu/SF for a thousand years*

*4q = 3q x 10 =39,420 x 10 =394,200 Btu/SF for TEN thousand years*

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***Deep Space Radiation (Stephan-Boltzman Law);***

*Q = E x F x A x K x (T1^4 –T2^4)*

*E = emissivity*

*F = form (or “coupling”) factor*

*A = Area of radiation/heat source*

*K = Boltzman constant = 5.6703 x 10^-8 Watt/SM/K*

*K = Boltzman constant = 0.173 x 10^-8 Btu/SF/R/h*

***Example: Q=0.4x1x5.6x10^15x0.173/10^8x(520^4–0)=2.816x10^17Btu/h***

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***Graphite-Globe** constitutes a fiction whereby;*

*1. CARBON must have been in abundance at the formation of the earth inasmuch as preceding Iron (Fe) in the Periodic Table (“**Cosmic Furnace**” hypothesis);*
*2. At a fusion temperature of 3,500C (6,760R) CARBON would have remained “solid” at formation ;*
*3. As a consequence of centrifugal force and relative density CARBON would have been distributed in a tight band close to the peripheral of the incipient earth (see fig),*
*4. The CARBON band would be mostly transformed into **Graphite** as a consequence of temperature and pressure.*

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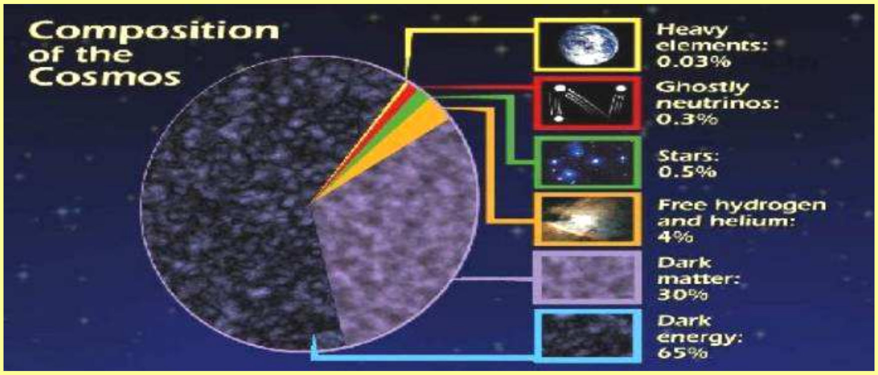
***Composition of the Cosmos*** *(source Hubble/NASA);*




*The universe mostly (95%) comprise, dark energy, dark matter, stars and clouds of gas. A tiny fraction (0.03%) is "heavy elements", the composition of planets and the earth.*

http://imgsrc.hubblesite.org/hu/db/images/hs-2001-09-h-pdf.pdf

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H He Li Be B C ..........**XXX** XXX = SUN

\>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> Total time =***16.21+5*** =***21.21BY***

*The **COSMIC furnace** hypothesis (actually real).*

**AGE OF THE UNIVERSE**: *PERFECT **sequencing** (...the doctrine of infinite resources!!)*

*H > He > Li > Be > B > C > N > O > Fl > Ne > Na > Mg > Al > Si > P > S*
***5.46>6.83>7.62>8.23>8.74>9.2>9.59>9.94>10.23>10.5>10.74>10.96>11.17>11.36>11.54>11.71 (16)***
*Cl > Ar > K > Ca > Sc > Ti > Cr > Fe > Co > Ni > Cu > Zi > Ga > Ge > As*
***11.87>12.01>12.15>12.28>12.41>12.52>12.63>12.73>12.83>12.93>13.03>13.12>13.21>13.29>13.37 (31)***
*Se > Br > Kr > Rb > Sr > Y > Zr > Nb > Mo > Tc > Ru > Rh > Pd > Ag > Cd*
***13.45>13.52>13.59>13.66>13.72>13.79>13.85>13.91>13.97>14.03>14.09>14.15>14.2>14.25>14.3 (46)***
*In > Sn > S > Te > I > Xe > Cs > Ba > La > Ce > Pr > Nd > Pm > Sm > Eu*

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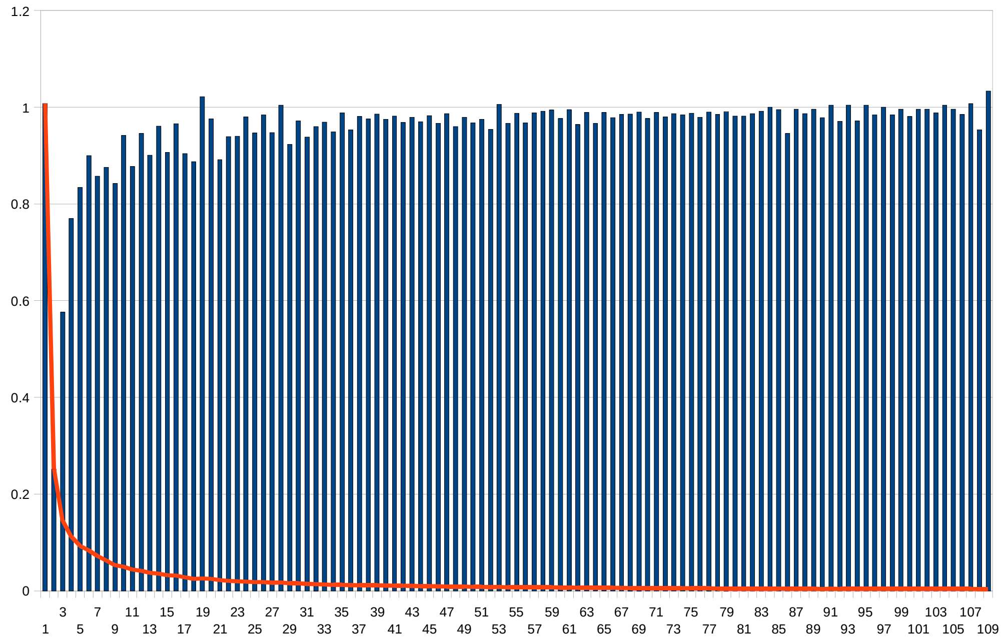


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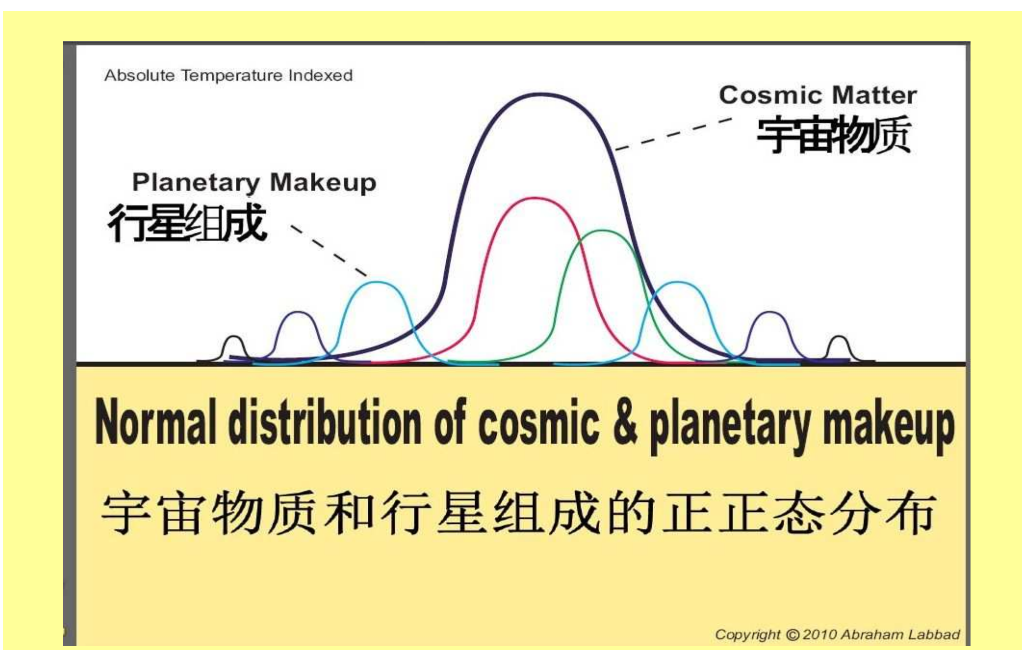

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4. The Binder-Schmidt Overview

4. Binder-Schmidt法概述

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***A. Binder-Schmidt Overview***

*A1. Binder-Schmidt origin;*

*The Binder-Schmidt (graphical) finite-difference method of solving transient heat flow in a solid was originally introduced by E Schmidt as a one-dimensional computational methodology in 1924 to deal with varying surface/boundary conditions. Binder subsequently coordinated with Schmidt to expand the methodology into three dimensions and cylindrical coordinates.*

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***A. Binder-Schmidt Overview***

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**A.Binder-Schmidt法的概述**

A1. Binder-Schmidt法起源;

用于分析固态瞬变热流动的Binder-Schmidt (图表) 有限 差法最初是由E Schmidt在1924年为解决变化表面或边界条件问题而采用的一种一维计算法。Binder 随后联合Schmidt 将这种方法扩展到三维和柱坐标系统中

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*A2. Modified Binder-Schmidt system;*

*The modified Binder-Schmidt system was developed in 1965 as a methodology to determine the rate/extent of freezing of liquid steel in steel-making furnaces and transportation vessels at the Research and Process Development division of the South African Iron and Steel Corporation.*

A2. Binder-Schmidt法的改进;

Binder-Schmidt在1965年时由南非钢铁公司的研发部门改进成一种用于确定液态钢在炼钢炉和转炉（运送钢水的容器）中凝固的程度的方法。

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***A3. Modified Binder-Schmidt algorithms;***

改进的 Binder-Schmidt法的运算法则;

$$\frac{\partial T}{\partial t} = \alpha \nabla^2 (T) + \frac{Q'}{\rho C_p} \ldots (1)$$

$$\frac{dT}{dt} = \alpha * \frac{d^2 T}{dx^2} \ldots (2)$$

$$dT = \alpha * dt * d\left(\frac{dT}{dx^2}\right) \ldots (3)$$

$$dT = \frac{1}{2} * \Phi * d(dT) \ldots (4)$$

>

$$\Phi = 2\alpha * \frac{dt}{dx^2} \ldots (5) \quad dt = \frac{dx^2}{2\sigma} \ldots (7)$$

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$$T_{m,\ n+1} = \frac{T_{m+1\ \ n} + T_{m-1\ \ n}}{2} \ldots(6)$$

$$T_{1,\ n+1} = \frac{T_{2,\ n} + T_{0,\ n}}{2} \ldots(8)$$

$$T_{1,\ n+1} = \frac{T_{2,\ n} + \frac{h}{k}}{2} \ldots(9)$$

>

$$dT = \alpha * dt * \frac{d(2T)}{dx^2} + dt * \frac{Q'}{C_p \rho} \ldots(10)$$

$$dT = \alpha * dt * \frac{d(dT)}{dx^2} + dt * \frac{Q}{C_p} \ldots(11)$$

$$dT = \frac{1}{2} * d^2 T + (\frac{Q}{C_p}) dt \ldots(12)$$

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$$\int \frac{1}{2} * d(dT) = -\int (\frac{Q}{C_p}) dt \ldots(13)$$

>

$$\int \frac{1}{2} * d(dT) = -\frac{K}{C_p} \ldots(14)$$

$$\Sigma \frac{1}{2} * d(dT) = -\frac{K}{C_p} \ldots(15)$$

$$Q_o = \sum_{n=n}^{n=n+i} (T_{m,n+1} - T'_{m+1,n+1}) * \frac{K}{\rho} [m=1] \ldots(16)$$

$$Q_i = \sum_{n=n}^{n=n+i} (T_{m,n+1} - T'_{m+1,n+1}) * \frac{K}{\rho} [m=0] \ldots(17)$$

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***B. Binder-Schmidt Summary***

*B1. Binder-Schmidt // Preamble;*

*Digital computers evolved in parallel with the turbo-jet engine and jet-transportation. Digital computing initially suffered from the mainframe/hardwire syndrome. The advent of FORTRAN and transistor circuitry in the late fifties opened the door to large-scale finite element analysis. Spreadsheets and 64bit personal computers conversely opened the door to the new discipline of interactive macro (supercomputer) modeling.*

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***B. Binder-Schmidt 法的概要***

B1. Binder-Schmidt // 导言;

数字计算机的发展推动着涡轮蒸汽发动机和喷气式飞机的发展. 数字计算机最初一直受到中央处理器/硬件等问题困扰。直到上世纪50年代晚期，随着FORTRAN语言和晶体管电路学的出现才打开了大规模有限元分析的大门。同样，电子数据表64B个人电脑的出现则打开了交互式大型建模（超型计算机）这一学科的大门。

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***B2. The title (1967 Master's thesis);***

*Modified "graphical" Binder-Schmidt (BS) "graphical" solution of the Fourier transient heat flow equation for a two-phase medium;*

***"Finite Slab Two-phase Liquid-solid Transient Heat Conduction with Transition Front Shift"***

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B2.题目（1967年的硕士毕业论文） The title (1967 Master's thesis);

修改的图表式Binder-Schmidt (BS)法用图表的形式通过两阶段中间过程去解析"傅里叶瞬变热流动运动方程"；

硕士论文题目：**"Finite Slab Two-phase Liquid-solid Transient Heat Conduction with Transition Front Shift"**

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**B3. The BS goal (1965);**

*"The essence of the problem is the development a mathematical theory to solve transient heat conduction problems in a bounded two-phase liquid-solid material with transition front shift".*

**B3. Binder-Schmidt法的目标 (1965);**

这个问题的实质是发明一种数学方法能用transition front shift去解决液-固两相材料的边界的瞬态热传导问题。

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**B4. The BS challenge (1965);**

*"In modern science it is essential that all physical processes can be accounted and predicted for and consequently calculations should be analyzed analytically where possible and correlated with the practice or experimentally (verified)".*

B4. Binder-Schmidt法的挑战(1965);

现代科学要求所有的物理过程都要能够被说明和预测，所以对计算过程都应该尽可能的进行仔细的验算和在相关的实践或试验中进行检验。

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***B5. BS Problem statement (1965);***

*"Transient heat conduction (with change of phase) is one of the many physical phenomena that cannot be solved fully analytically and exact solutions are limited to bounded hypothetical conditions (TR Goodman, ASME 1958)".*

B5. Binder-Schmidt 法的问题陈述 (1965);

瞬态热传导（变阶段）和很多物理现象一样，因为边界假设条件的限制，所以都还不能被彻底的分析清楚和完全的解决。(TR Goodman, ASME 1958)

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***B6. Electronic/digital computers (1965);***

*"The introduction of electronic computers opened new fields of theoretical study which was not possible earlier due t the great amount of work characteristic to the particular analytic solution methods".*

B6. 数字计算机(1965);

数字计算机的引入，为理论研究开辟了新天地。过去由于无法进行数量庞大的运算而无法解决的问题，现在可以被很透彻的分析了。

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***B7. Authorities (homogeneous materials) (1965);***
B7. 专家 (均匀材料方面的) (1965);

*Heisler and Groeber Charts*
*Friedman.Mann and Wolf*
*Abarbanel and Fairal*
*Carslaw and Jaeger*
*HG Landau*
*ST Hsu*


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***B8. Authorities (two-phase materials) (1965);***
B8. 专家 (复相材料方面的) (1965);


***CA Forster**: Finite Difference Approach to Some Heat Conduction Problems Involving Change of State – English Electric Company 1954. **TR Goodman**: The Heat-balance Integral and Its Application to Problems Involving a Change of Phase – ASME 1958. **LL van Zyl**: An Electronic Analogue computer for the solution of non-linear partial differential equations encountered in the study of self-heating of fishmeal – SACAC (Johannesburg) 1963. **Rallis and Freed**: Analogue computer solutions for the Heat Conduction Equation – University of the Witwatersrand 1963. **WH Giedt**: Binder-Schmidt // Principles of Engineering Heat Transfer -- van Norstrand 1957.*

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## B9. General Fourier Equation for transient heat conduction;

$\partial T/\partial t = \alpha\nabla$^2(T) + Q'/$\rho$Cp ...(1),

where T = absolute temperature, t = time, $\alpha$ = thermal diffusivity, $\nabla$ = spherical coordinates (x/y/z), Q' = internal heat production (Btu/ft^3/h), $\rho$ = density (ft^3) and Cp = specific heat (Btu/lb/F).

Dimensions: LH ={T/t}; RH ={ft^2/h*T/ft^2} + {(Btu/ft^3/h)*(ft^3/lb)*(lbT/Btu)} ={T/t}

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## B9.一般傅里叶方程（瞬态热传导）;

$$\frac{\partial T}{\partial t} = \alpha\nabla^2(T) + \frac{Q'}{\rho C_p} \ldots(1),$$

其中：$T$为绝对温度；$t$为时间；$\alpha$为热扩散系数；$\nabla$为球面坐标（x/y/z）；$Q'$为内部放热(Btu/ft$^3$/h)；$\rho$为密度(ft$^3$)和$C_p$为比热(Btu/lb/F)。

Dimensions: LH ={T/t}; RH ={ft$^2$/h*T/ft$^2$} + {(Btu/ft$^3$/h)*(ft$^3$/lb)*(lbT/Btu)} ={T/t}

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***B10. Binder-Schmidt (one dimensional) Fourier Truncation;***

*In order to create a recursive enumeration platform without automated computational means, Binder/Schmidt reduced the generalized 3-dimensional Fourier structure to a **one-dimensional platform** for a homogeneous/solid material with Q'/ρCp=0. Binder/Schmidt consequentially differenced and reorganized the general Fourier differential equation to dT/dt = α*d^2T/dx^2 …(2), OR conversely in the **limit** that dx>>zero, dT = α*dt*(d(dT)/dx^2) …(3).*

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B10. Binder-Schmidt (一维) 傅里叶变换;

对于均匀材料，为了不用自动化计算方法建立一个递推枚举平台，Binder和Schmidt将三维傅里叶通过 $Q'/\rho C_p = 0$ 减少成一维. Binder和Schmidt将一般傅里叶微分方程分别改写成

$$\frac{dT}{dt} = \alpha * \frac{d^2T}{dx^2} \ldots(2)$$

或当dx趋近0时，

$$dT = \alpha * dt * d\left(\frac{dT}{dx^2}\right) \ldots(3)$$

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## B11. Elemental Binder-Schmidt graphical platform;

*In the absence of automated computational means Binder/Schmidt adopted **graphical means** (ie the intersection of vector lines on a drafting platform), as means to perform elementary divisions. By differencing (or dividing) the conductive medium hence in a number of equal layers (the X-plane) and allowing for successive temperature vectors (Y-pane) to be crossed, Binder/Schmidt was able to create a computational platform on a drafting table (see figure1).*

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## B11. 基本Binder-Schmidt图表平台；

在不采用自动计算方法的情况下，**Binder**和**Schmidt**采用了图表的方式**(**例如向量线的交叉**)**去表达基本除法**.**为了区别传导介质，横向上（**X**轴）的分层和纵向（**Y**轴）连续温度向量进行交叉。他们能够在草稿表中建立一个计算平台（见图**1**）

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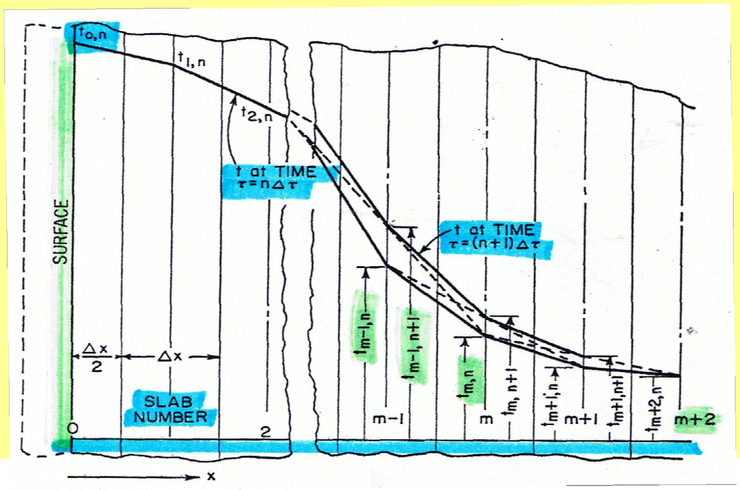
**Figure1: Binder-Schmidt “intersection” protocol**
图Binder-Schmidt的 “交叉”草稿.

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**B12. Binder-Schmidt differencing methodology;**

*In accordance with the graphical protocol Binder/Schmidt restructured the truncated Fourier equation $dT = \alpha*dt*(d(dT)/dx^2)$ …(3) as $dT = ½*\Phi*d(dT)$ …(4), where $\Phi = 2\alpha*dt/dx^2$ …(5). In accordance with the doctrine of finite limits, equation (4) may hence be differenced as $Tm/n+1 = (Tm+1/n + Tm-1/n)/2$ …(6), given $\Phi$ = 1 and n and m the incremental time and slab denominations respectively.*

*However in event $\Phi$ = 1, then $2\alpha*dt/dx^2 = 1$, $\alpha*dt/dx^2= ½$ and $dt = dx^2/2\sigma$ …(7).*

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***B12. Binder-Schmidt差分法;***

为了与“交叉”草案保持一致，Binder和Schmidt将傅里叶方程

$dT = \alpha * dt * d(\frac{dT}{dx^2})...(3)$ 简化为 $dT = \frac{1}{2} * \Phi * d(dT)...(4)$，其中，$\Phi = 2\alpha * \frac{dt}{dx^2}...(5)$.

根据有限差理论，方程 (4) 也许会不同，因为 $T_{m,\ n+1} = \frac{T_{m+1\ n} + T_{m-1\ n}}{2}...(6)$，假设

$\Phi = 1$ and $n$ and $m$ 代表时间和厚度分别不断增加。假设 $\Phi = 1$，那么 $2\alpha * \frac{dt}{dx^2} = 1$，

$\alpha * \frac{dt}{dx^2} = \frac{1}{2}$，得 $dt = \frac{dx^2}{2\sigma}...(7)$


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***B13. The elemental boundary conditions;***

*In accordance with the elemental differencing function given m=1 (the outer boundary), the generalized differencing algorithm equation …(6), reduces to T1/n+1 = (T2/n + T0/n)/2 …(8). However as **T0** is non-existent at the nth instant, **T0** is set as **h/k**. The boundary condition for the elemental Fourier algorithm at the n+1th instant hence reduces to T1/n+1 = (T2/n + h/k)/2 …(9), where **h** is the convection coefficient and **k** the conductivity of the solid medium at task. The same rationale as for the inner is applied as to the outer boundary (see figure2).*

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***B13. 基本边界条件;***

根据基本差分函数，假设$m=1$(外部边界)，由广义差分运算规则方程

$T_{m,\ n+1}=\dfrac{T_{m+1\ n}+T_{m-1\ n}}{2}$...(6) 可以推导出 $T_{1,\ n+1}=\dfrac{T_{2,\ n}+T_{0,\ n}}{2}$...(8)，其中$T_0$是不存在的，将$T_0$ ***设为***$\dfrac{h}{k}$. 则（8）式变为$T_{1\ n+1}=\dfrac{T_{2,\ n}+\frac{h}{k}}{2}$...(9)，其中$h$代表对流系数，$k$代表固态介质的传导率。另外，内部边界条件同外部边界条件（见图2）

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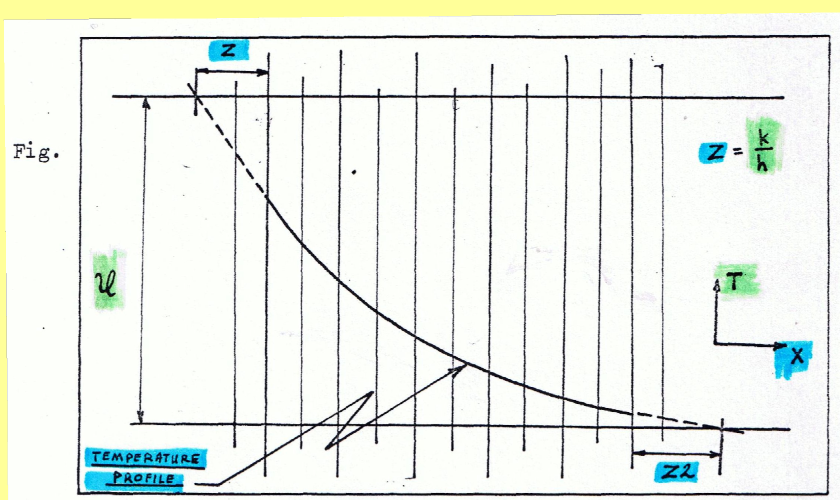
***Figure2: Binder-Schmidt boundary conditions***

图2: Binder-Schmidt 边界条件



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## B14. The two-phase (modified) Binder-Schmidt methodology;

*The generalized Fourier equation for transient heat conduction $\partial T/\partial t = \alpha\nabla\text{^}2(T) + Q'/\rho Cp$, equation …(1), may be restated in one dimension partial format as $dT = \alpha * dt * d(2T)/dx\text{^}2 + dt * Q'/\rho Cp$ …(10). Substituting Q' hence with $\rho Q$ (Q ={Btu/lb/h}), then equation …(10) reduces to $dT = \alpha * dt * d(2T)/dx\text{^}2 + dt * \rho Q/\rho Cp$ **=** $\alpha * dt * d(dT)/dx\text{^}2 + dt * Q/Cp$ …(11).*

*Substituting **dt** = **$dx\text{^}2/2\sigma$** in accordance with …(7), equation …(11) may be restructured as $dT = ½ * d\text{^}2T + (Q/Cp)dt$ …(12). Equation …(12) becomes the key to unlocking the change-of-phase transition.*

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***B14 两阶段(改进的) Binder-Schmidt 法;***

描述瞬态热传导的广义傅里叶方程 $\frac{\partial T}{\partial t} = \alpha\nabla^2(T) + \frac{Q'}{\rho C_p}$...(1)也可以表示为

$dT = \alpha * dt * \frac{d(2T)}{dx^2} + dt * \frac{Q'}{C_p \rho}$...(10)。用 $\rho Q$ 代替 $Q'$，则可推导出

$dT = \alpha * dt * \frac{d(dT)}{dx^2} + dt * \frac{Q}{C_p}$...(11)，结合 $dt = \frac{dx^2}{2\sigma}$...(7) 可得

$dT = \frac{1}{2} * d^2T + (\frac{Q}{C_p})dt$...(12)。式(12)可以很好的是解释change-of-phase transition。

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## B15. The two-phase Binder-Schmidt differenced algorithm;

*Given dT = ZERO during fusion OR melting, equation …(12) may be rewritten as ½*d(dT) = -(Q/Cp)dt, OR ∫1/2*d(dT) = -∫(Q/Cp)dt …(13). However substituting **Q** (the heat generated per lb/h) with **K/dt**, where **K** = the heat of transformation expressed in Btu/lb and dt = dx^2/2σ <the incremental time differential> in accordance with …(7)), then the Fourier condition may be reduced to ∫ 1/2*d(dT) = -K/Cp …(14), OR in terms of **Binder-Schmidt** differencing protocol as*

*∑1/2*d(dT) = -K/Cp …(15) (see figure3 as to real time implication).*

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### *B15. 两阶段 Binder-Schmidt 差分运算法则;*

假设在融化时 $dT=0$， (12)式可以改写成 $\frac{1}{2}*d(dT)=-(\frac{Q}{C_p})dt$ 或 $\int\frac{1}{2}*d(dT)=-\int(\frac{Q}{C_p})dt ...(13)$，如果用 $K/dt$ ***替换*** $Q$ (the heat generated per lb/h)，其中 $K$ 是用Btu/lb和 $dt=\frac{dx^2}{2\sigma}$ <the incremental time differential>表示的转变热，那么傅里叶条件化为 $\int\frac{1}{2}*d(dT)=-\frac{K}{C_p}...(14)$，或从***Binder-Schmidt***差分草案的角度化为 $\Sigma\frac{1}{2}*d(dT)=-\frac{K}{C_p}...(15)$ (见图3).

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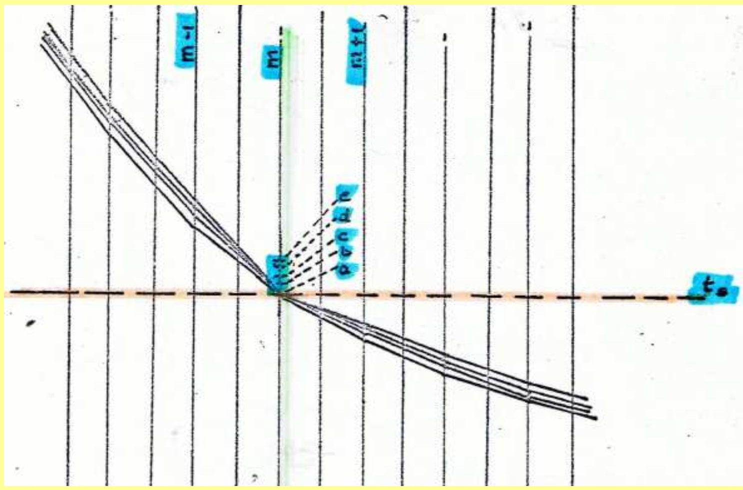
***Figure3: Two-phase Binder-Schmidt protocol***

图3: 两阶段Binder-Schmidt草案

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***B16. Boundary conditions for the two-phase transition;***

*In accordance with elemental Binder-Schmidt boundary conditions equations …(8)/(9), ie $T1/n+1 = (T2/n + T0/n)/2$ and $T1/n+1 = (T2/n + h/k)/2$, equation …(15) may be rewritten as;*

*$Qo = n\text{-}n+i/n=n\ \Sigma(Tm,n+1 - T'm+1,n+1)*K/\rho)$ [m=1] …(16) and $Qi = n\text{-}n+i/n=n\ \Sigma(T'm,n+1 - T''m+1,n+1)*K/\rho)$ [m=0] …(17), where T' and T'' are the apparent OR pseudo (incremental/differenced) temperature increases.*

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***B16.两阶段转变的边界条件;***

由基本的Binder-Schmidt边界条件方程式（8）和式（9），式（15)可改写为

$$Q_o = \sum_{n=n}^{n=n+i} (T_{m,n+1} - T'_{m+1,n+1}) * \frac{K}{\rho} [m=1]..(16)\text{和}$$

$$Q_i = \sum_{n=n}^{n=n+i} (T_{m,n+1} - T'_{m+1,n+1}) * \frac{K}{\rho} [m=0]..(17)$$ ,其中$T'$和$T''$代表虚假的温度增加。

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## ***B17. PEQ: Binder Schmidt Crust Model***

*500 Miles =2,640,000 ft*
*16x layers =165,000 ft/layer*
*T(m, n+1) =T(m-1, n+1) -(dX/(dX/2+z2))*(T(m-1, n+1) -TK)*
*T(m, n+1) =T(m-1, n+1) -(dX/(dX/2+z2))*(T(m-1, n+1) -TF)*
*TW(n+1) =(T(m, n+1) +T(m+1, n+1))/2*
*T(m, n+1) =T(m-1, n) +T(m+1, n))/2*
*T(m, n+1) =T(m-1, n) +TK)/2*

*Dtime =(dL^2 / 2 / k) x Cp x de*
*Dtime = (1.65^2 / 20) x 200 / 8,500*
*Dtime=270/850x10^8=32M years*
*TQ =QL/Cp =180/0.18 =1,000F*
*Zo = 500 960 R; Zs= 140 600 R*

*Eo Es Zo To.F 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15*

*1 0.4 0.8 144 6000 6460 6460 6460 6460 6460 6460 6460 6460 6460 6460 6460 6460 6460 Tabulation*
*2 0.4 0.8 144 3540 4000 5230 5845 6153 6306 6383 6422 6441 6450 6455 6458 6459 6459 6460 6460 698*
*3 0.4 0.8 144 2540 3000 4423 5288 5797 6090 6256 6348 6399 6427 6442 6451 6455 6457 6459 6459 313 101*
*4 0.4 0.8 144 1823 2283 4000 4898 5494 5875 6112 6255 6341 6392 6421 6438 6448 6453 6456 6458 38 38*
*5 0.4 0.8 144 1612 2072 4000 4747 5311 5711 5983 6162 6277 6349 6394 6421 6437 6447 6452 6455 515 553*
*6 0.4 0.8 144 1612 2072 3900 4606 5158 5571 5867 6072 6211 6302 6361 6399 6423 6438 6446 6451 490 104*

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## B18. PEQ: Binder Schmidt MACRO Model

-

T(m, n+1) =T(m-1, n+1) -(dX/(dX/2+z2))*(T(m-1, n+1) -TK)
G T(m, n+1) =T(m-1, n+1) -(dX/(dX/2+z2))*(T(m-1, n+1) -TF)
R TW(n+1) =(T(m, n+1) +T(m+1, n+1))/2
A T(m, n+1) =T(m-1, n) +T(m+1, n))/2
D T(m, n+1) =T(m-1, n) +TK)/2

1,000 Miles =5,580,000ft
40x layers =140,000 ft/layer
Dtime =(dL^2 / 2 / k) x Cp x de
Dtime = (140^2 / 20) x 200 / 8,500
Dtime=196/850x10^8=23Myears

QL 180 177 174 171 168 165 162 159 156 153 150 147 144 141 138 135 132 129 126 123 120 117 114 111 108
Cp 0.18 0.18 0.18 0.17 0.17 0.17 0.17 0.17 0.16 0.16 0.16 0.16 0.16 0.15 0.15 0.15 0.15 0.15 0.14 0.14 0.14 0.14 .

ZF 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000
Tf 3000 3010 3020 3030 3040 3050 3060 3070 3080 3090 3100 3110 3120 3130 3140 3150 3160 3170 3180 3190

Miles 25 50 75 100 125 150 175 200 225 250 275 300 325 350 375 400 425 450 475 500 525 550 575 600 625
23 0.5 0.70 To.F 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

By Ho Hs h k k/h 6000 6025 6050 6075 6100 6125 6150 6175 6200 6225 6250 6275 6300 6325 6350 6375 6400
1 0.00 1121040 197 172.4601 2 0.01 6460 6485 6510 6535 6560 6585 6610 6635 6660 6685 6710 6735
6460 6485 6510 6535 6560 6585 6610 6635 6660 6685 6710 6735 6760 6785 6810 6835 6860 6885 6910
3244 4877 5706 6133 6359 6484 6560 6610 6647 6679 6707 6733 6759 6785 6810 6835 6860 6885 6910 6935

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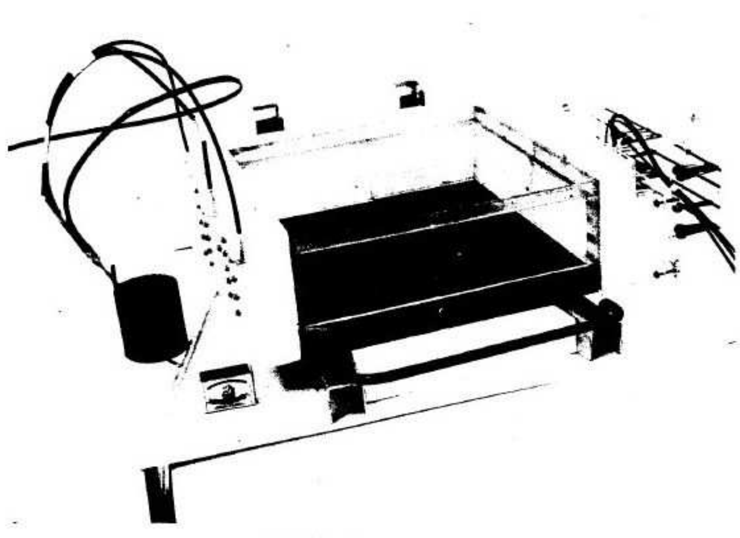
## 1966 MS Experimental Model (Plexiglas): Thermocouple Strands



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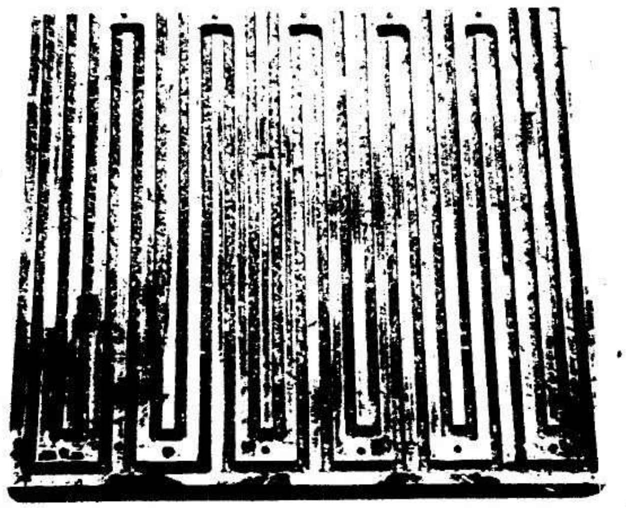
**1966 Experimental Model: Heat-transfer Plates (copper) with Groves**



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**1966 MS Experimental Model: Experimental Setup with (pen) Recorder**

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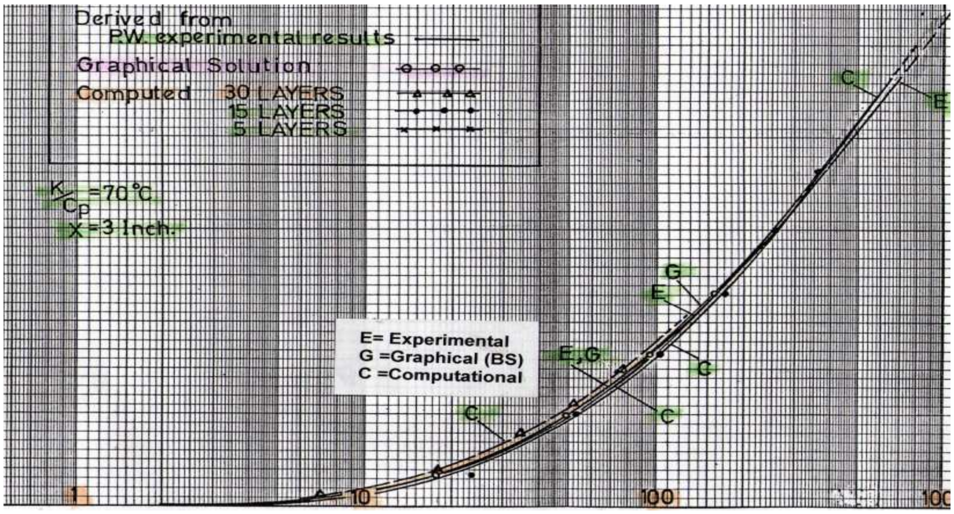
**1966 Binder-Schmidt Computational and Experimental Correlation Plot**

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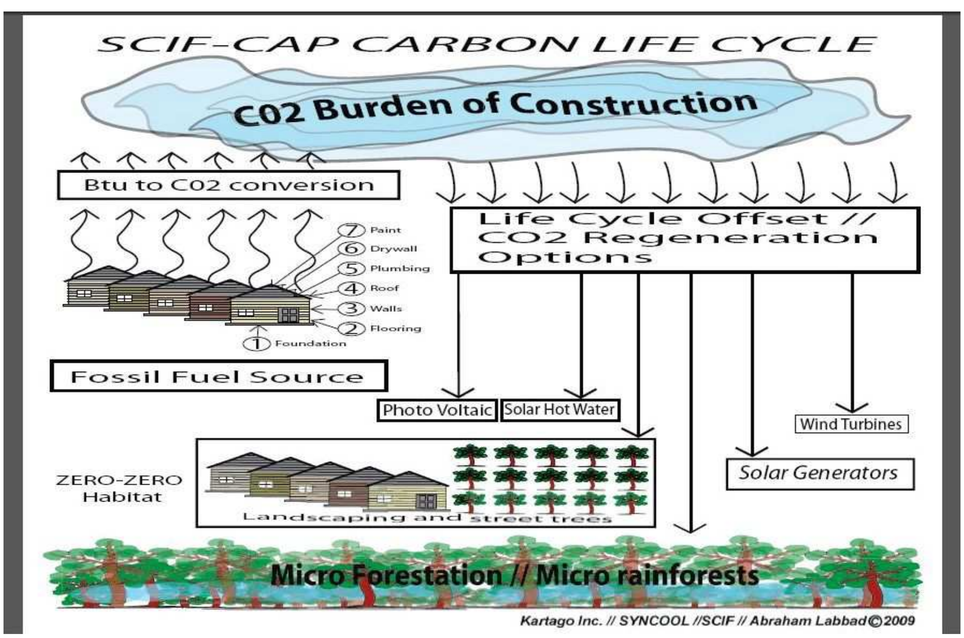

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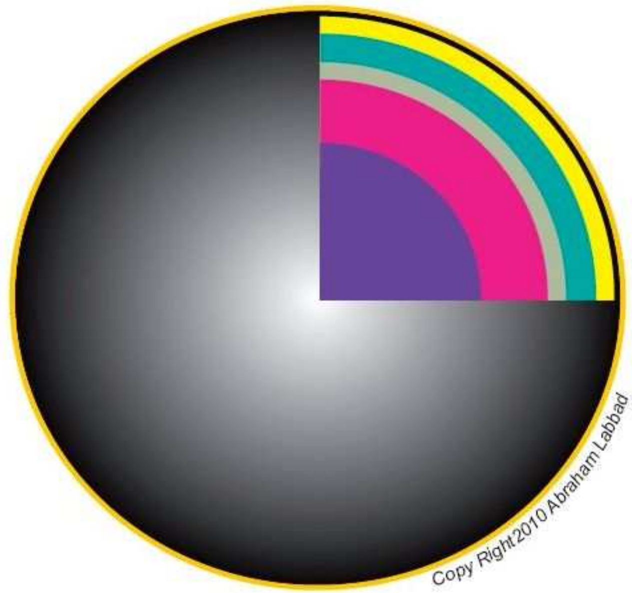


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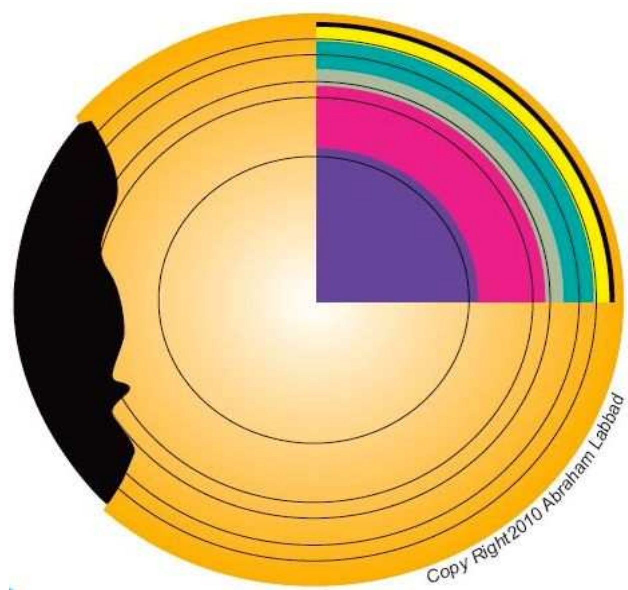

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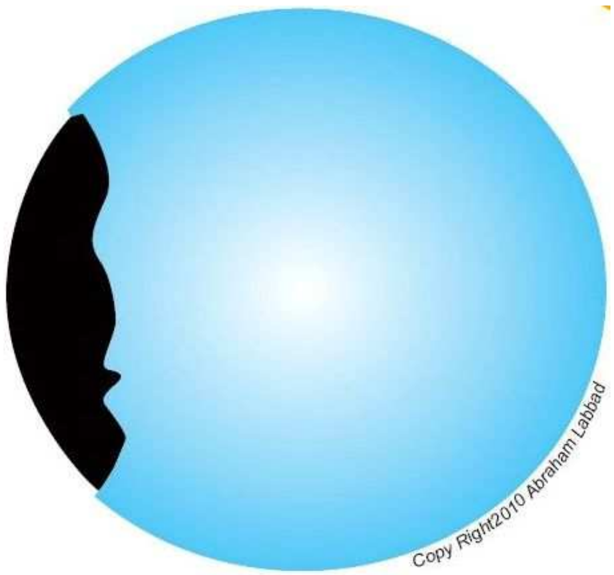


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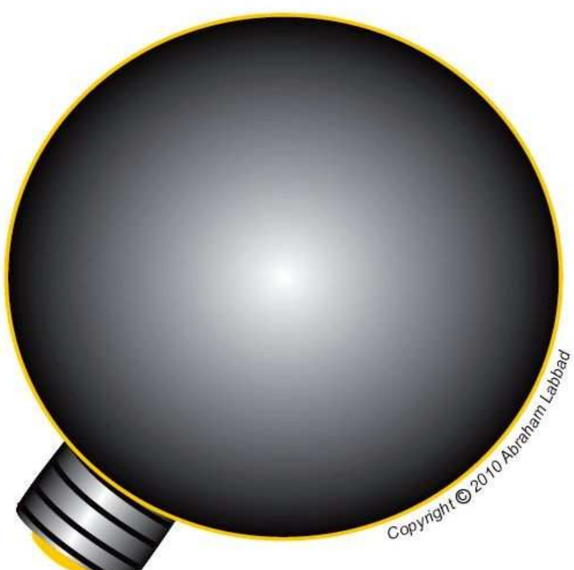

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## 5. Selected ComputationalTopics;

*Spreadsheet setup, Crust analysis, CFD and FORTRAN models*

5. 可选的计算论题

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## 6. Selected Research/Consultation/PhD Topics;

***Cosmic Furnace analysis, Polar Ice-CFD model, Polar Inversion-CFD model, Micro-Forestation analysis, Deep-Space radiation model etc etc***

6. 可选的研究/磋商/博士论文题目