

Physics 128 Lecture

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Resuscitatus = Separate the Regulus from the

NOTE. For the primam cow Meliodic: The liquid Potassa must be of great concentration. Different Methods and the liquid of gold brought else they would be useless and the experiment would hardly succeed. Refer to notes on page 110 for detailed analysis. Indeed, from antiquity until well into the Modern Age, a physics devoid of metaphysical insight would have been as unsatisfying as a metaphysics devoid of physical manifestation.

Ingredient/Potion/Antidote - MEDIEVAL METHOD

Ingredient Potion Antidote

	✠				✠				☉			
	30	Aug	10	10	30	Aug	10	10	30	Aug	10	10
	in	in	in	in	in	in	in	in	in	in	in	in
<u>Epeditus</u>	1	11	21	24	31	41	51	54	61	71	81	84
<u>Longinquus</u>	2	16	26	29	36	46	56	59	66	76	86	89
<u>Profusus</u>	3	18	28	31	38	48	58	61	68	78	88	91
<u>Botanum complementatus</u>	4	19	29	32	39	49	59	62	69	79	89	92
<u>Magueth's I</u>	5	20	30	33	40	50	60	63	70	80	90	93
<u>Magueth's II</u>	6	21	31	34	41	51	61	64	71	81	91	94
<u>Magueth's III</u>	7	22	32	35	42	52	62	65	72	82	92	95
<u>Pododere and Aquaboz.</u>	8	23	33	36	43	53	63	66	73	83	93	96
	9	24	34	37	44	54	64	67	74	84	94	97
	10	25	35	38	45	55	65	68	75	85	95	98
	11	26	36	39	46	56	66	69	76	86	96	99
	12	27	37	40	47	57	67	70	77	87	97	100

Project gradually of Part II, 1/2 drachms (2 scoops) of a thin, very soft, or sweetener into a small iron spoon, let the whole 3 drachms be used.

Take of Crude Putrimony 1/2 oz, of fine gold 1/2 oz, of iron or steel filings powdered. Melt together in a crucible in a mild furnace even quarter of an hour project from a silver spoon.

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the potash is to be melted by lying in the water in small pieces till it is hard - first must be washed and well sustained - must be contained for

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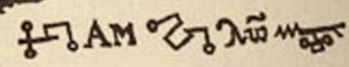
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Below two treatise contents of * SPHERA SATURNI *

ADVANCED POTION MAKING

The best known goals of the alchemists were the transmutation of common metals into Gold or Silver (less well known is plant alchemy, or "Spagyric"), and the creation of a "panacea," a remedy that supposedly would cure all diseases and prolong life indefinitely, and the discovery of a universal solvent.

Preparation of Efficacious Potion



Add Myrtle and Cleavert Root and of the best English Alum

The Right Use of the Ingredients

Alchemists enjoyed prestige and support through the centuries, though not for their pursuit of those goals, nor the mystic and philosophical speculation that dominates their literature. Rather it was for their mundane contributions to the chemical industries of the day: the invention of gunpowder, ore testing and refining, metal working, production of ink, dyes, paints, and cosmetics, leather tanning, ceramics and glass manufacture, preparation of extracts & liquors, and so on. It seems that the preparation of aqua vitae, the "water of life", was a fairly popular "experiment" among Europeans.



Potions, from antiquity until well into the Modern Age, a physics devoid of metaphysical insight would have been as unsatisfying as a metaphysics devoid of physical manifestation. For one thing, the lack of common words for chemical concepts and processes, as well as the need for secrecy, led alchemists to borrow the terms and symbols of biblical and pagan mythology, astrology, kabbalah and other mystic and esoteric fields; so that even the plainest chemical recipe ended up reading like an abstruse magic incantation.



FIG. 1 - from antiquity until well into the Modern Age, a physics devoid of metaphysical insight would have been as unsatisfying as a metaphysics devoid of physical manifestation. For one thing, the lack of common words for chemical concepts and processes, as well as the need for secrecy, led alchemists to borrow the terms and symbols of biblical and pagan mythology, astrology, kabbalah and other mystic and esoteric fields.

As soon as ever the ferment is added to the substance it presently begins to ferment, and the glass being placed in salina, and kept off the fire, the white spirit of iron rises naturally and cleanly, like spirit of Saturn.

Aligis referre huius visum

Potion with Compound of ...

Some assumptions...

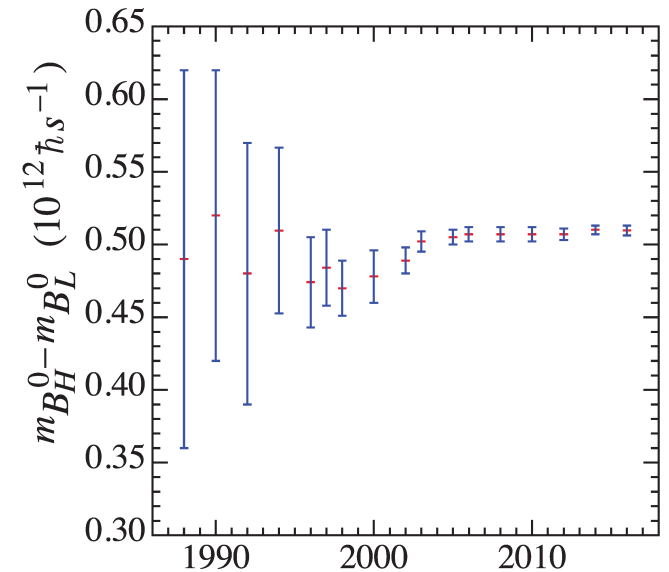
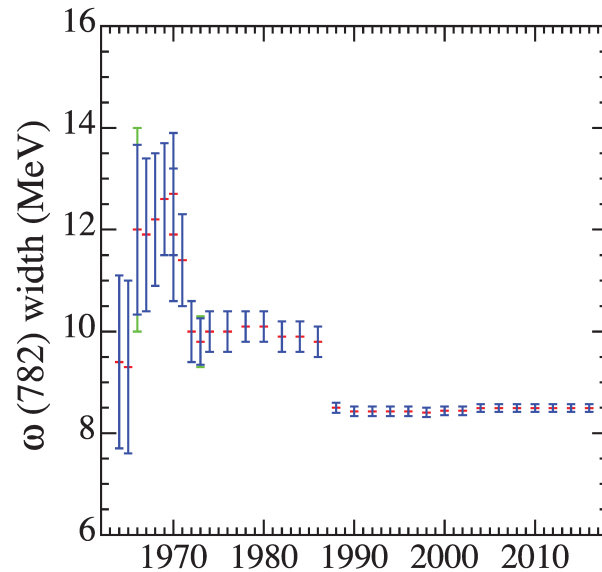
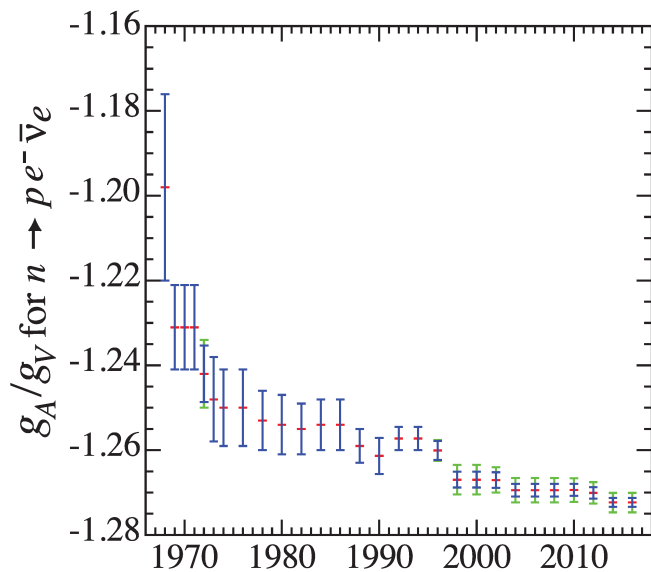
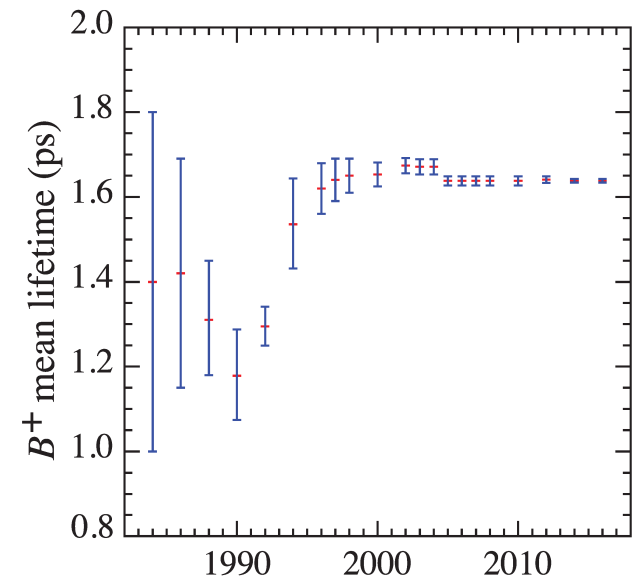
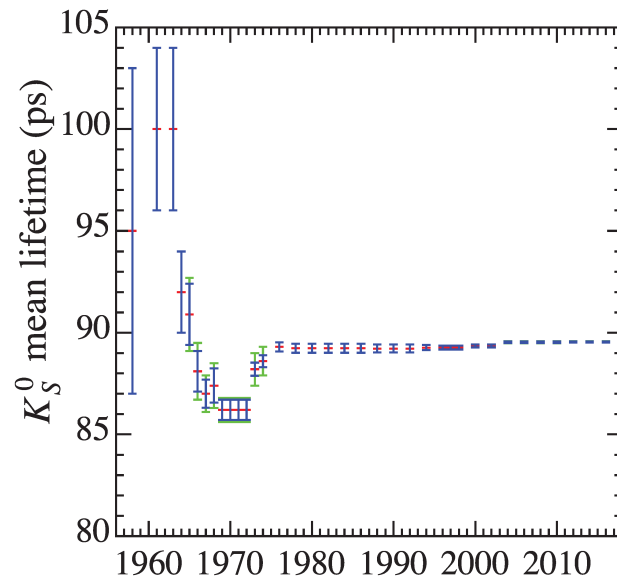
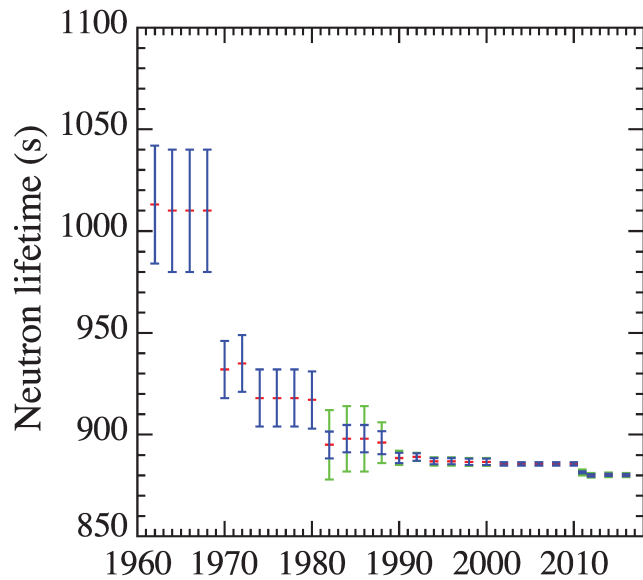
- You have taken enough high-school statistics, quantum mechanics, to understand:
 - Mean of a distribution
 - Standard Deviation of a distribution
- Good reference: Bevington/Robinson... first 4 chapters
- You know the Gaussian distribution

$$p_G = \frac{1}{\sigma \sqrt{2\pi}} \exp \left[-\frac{1}{2} \left(\frac{x - \mu}{\sigma} \right)^2 \right]$$

More...

- You're not used to the "ad hoc" nature of how experimental physics exploits statistics. Kind of like jazz or composition in music... your textbook learning is like playing from sheet music handed to you.
- Experimental physics: language doesn't even agree internally, or with academic statisticians.
- **However, in all (particularly experimental) science you must make error estimates. No error estimate... it is not science.**
- Best effort always appreciated. No effort... unacceptable. Mistakes... healthy scientific critique. You'll need a thick skin... it is not about you, but, the science.
- Experimental science... a drive to the smallest error... sometimes, when "sensitivity" (like $1/(\text{error size})$) passes a threshold, great new discoveries possible.
- Page 14-15 of Bevington... many types of errors. Big categories: "important", "statistical", "systematic" are major. Others... "extrinsic" and "intrinsic".

Some particle physics measurements over time



All roads lead to... Gaussian
(aka, the central limit theorem)

$\{x_i\} = 0$'s and 1 's, equal probability; N picks

$\bar{x} = \frac{1}{N} \sum x_i$...known as the “sample mean”

$s^2 = \frac{1}{N-1} \sum (x_i - \bar{x})^2$... “sample variance”

Imagine getting N measurements, computing \bar{x} , and *repeating that* many times. You'll get a set $\{\bar{x}_j\}$.

Central limit theorem

How are $\{\bar{x}_j\}$ distributed?

Central limit theorem

How are $\{\bar{x}_j\}$ distributed?

As $N \rightarrow \infty$, \bar{x}_j are distributed about μ , ($= 1/2$ in this example) in a Gaussian distribution with:

$$\sigma_{\bar{x}} = \frac{s}{\sqrt{N}}$$

for “arbitrary” distribution of x_i

Error propagation

Sphere $V = \frac{4\pi}{3} r^3$

$\bar{r} \pm \sigma_r$... what is σ_V ?

$$\delta V = 3 \frac{4\pi}{3} r^2 \delta r \quad \text{take average}$$

$\frac{\partial V}{\partial r} \quad \langle \delta r \rangle = 0!$

$$\langle \delta V^2 \rangle = \left(3 \frac{4\pi}{3} \bar{r}^2 \right)^2 \langle \delta r^2 \rangle$$

$$\sigma_V^2 = \left(3 \frac{V}{r} \right)^2 \sigma_r^2$$

$$\left[\frac{\sigma_V}{V} = 3 \frac{\sigma_r}{r} \right] \quad \text{"power law"}$$

Cylinder $V = \pi r^2 h$ $\bar{r} \pm \sigma_r$ $\bar{h} \pm \sigma_h$

$$\delta V = (2\pi r) \delta r + \pi r^2 \delta h \quad \rightarrow \langle \delta V \rangle = 0$$

$\frac{\partial V}{\partial r} \quad \frac{\partial V}{\partial h}$ "correlation"

$$\langle \delta V^2 \rangle = (2\pi \bar{r} \bar{h})^2 \langle \delta r^2 \rangle + 2(2\pi \bar{r} \bar{h})(\pi \bar{r}^2) \langle \delta r \delta h \rangle + (\pi \bar{r}^2)^2 \langle \delta h^2 \rangle$$

$= 0$
usually

$$= \left(2 \frac{V}{r} \right)^2 \langle \delta r^2 \rangle + \left(\frac{V}{h} \right)^2 \langle \delta h^2 \rangle$$

$$\frac{\sigma_v^2}{V^2} = \underbrace{\left(2 \frac{\sigma_r}{r}\right)^2 + \left(\frac{\sigma_n}{n}\right)^2}$$

fractional errors
in quadrature

$$z = x + y$$

$$\sigma_z^2 = \sigma_x^2 + \sigma_y^2$$