A prediction that bulk mercury without 201Hg may be solid in STP

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Abstract

In standard temperature and pressure (**STP**), mercury is liquid. Natural mercury comprises **7** isotopes with different sibling abundance, and the isotope **201Hg** is special one with abundance **13.2%**, because its nucleus has a very low energy level of first excited state, i.e. <**1.6keV**. If 201Hg is totally depleted from a bulk with critical mass at least, then this paper predicts that the depleted bulk will be no longer liquid and less sensitive to temperature change.

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Introduction

Mercury **201Hg** is the most outstanding isotope because its first energy level of nucleus is merely **1.6keV**, only second lowest to the **77eV** of uranium **235U**.

The most abundance neutrinos on Earth are **thermal neutrinos** which De-Broglie's matter wavelengths are from ultraviolet to infrared band, e.g. **1keV** neutrino's matter wavelength **0.2nm**. Such low energy thermal neutrinos are in energy level range from single to double digitals **keV.**

Not like as hot high energy neutrinos, recent researches reveal that extreme low energy thermal neutrino rays possess similar optical properties with visible or infrared light, i.e. they can transfer energy to matter by energy absorption of neutral current, also be reflected or refracted on media interface.

Therefore, it is mercury but not uranium that is subject to the influence of ambient thermal neutrinos.

Extending the reason why mercury is liquid and so sensitive to temperature

The previous element of mercury is gold that is expensive solid metal. Why the gold's neighbor mercury is abruptly becoming liquid and so sensitive to temperature?

Although the electrons configuration of mercury atom seems able to explain such a phenomenon, however it is not perfectly convincible; especially the high sensitivity of temperature can not be well explained by its electron shell structure.

The sibling abundance of **201Hg** is **13%**, combined with its heat perturbation of **1.6keV** nuclear energy level damping ambient neutrinos energy then gamma decaying, and its electron-shell inert $\mathbf{6s^2}$ relativistically affected orbital electron pair, perhaps, that is why the melting point of mercury is as low as **-38.8°C**, because the environment exists rich commensurate low energy neutrinos in all directions, and harvesting the energy of low energy neutrinos can make mercury very sensible to temperature, so result in high thermal expansion.

The reaction equations:

$$\nu + {}^{201}\mathrm{Hg} \rightarrow \nu' + {}^{201}\mathrm{Hg}^*$$

$${}^{201}\mathrm{Hg}^* \rightarrow {}^{201}\mathrm{Hg} + \boldsymbol{\gamma}\ (1.6\mathrm{keV})$$

It is difficult to detect the internal **1.6keV** photons in bulk mercury from outside, because it can be easily absorbed by orbital electrons or surrounding nuclei then converted to thermal energy.

Even a neutrino does not transfer energy to any mercury nucleus before it leaves, if the bulk mercury has enough mass, thermal neutrinos super high refractive index ($\gg$ **2.0**) may enable its ray to undergo optical internal full reflection, then more chance to impact mercury.

Therefore, if removing all isotope **201Hg** from bulk mercury with enough mass, its physic properties will change significantly, especially its melting point may increase greatly, even possibly it is solid in STP environment, and no more sensitive to temperature change.

Currently there is no **201Hg** depleted bulk mercury in market, thus no direct proof to my above prediction, but it is not hard to produce enough modified bulk mercury.

As to the bulk critical mass and accurate modified melting point and heat coefficient of expansion for the said depleted mercury, further research is needed.

Possible usage of mercury in thermal neutrino optics

Transparent glass is good material for visible optics, because its dielectric property can affect low energy "thermal" photons significantly, but not good for high energy photons, such as X-ray and gamma ray.

In a similar way, natural mercury should be good material for low energy thermal neutrino optical applications, because its isotope **201Hg** has big cross section with neutrinos in a couple of **keVs** range.

Therefore, the opaque mercury can be used to make thermal neutrino lens, and such a lens can focus thermal neutrinos into a point, then the focused neutrinos can trigger nuclear energy release from high spin locked beta decay potential elements, such as **50V**, **176Lu**, etc.

Thermal neutrino lens can also be used to image stellar internal structure. It can help humankind to research how star is formed and other mysterious astrophysical phenomena.

If mercury is cooled below **4.2K**, it becomes superconductor. Infusing mercury superconductor with large electric current, it can perfectly reflect thermal neutrinos. A paraboloid mirror can also focus thermal neutrinos and catalyze nuclear beta decay.

As natural mercury is liquid, thus it is very convenient to make lens or mirror in different curve, even possible to dynamically change focal length.

Reference

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