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Positronium Atoms Ride Alfven Waves Orbiting Jupiter & Europa with 160yr & 3.8dy lifetimes Emitting 440MHz & 110khz Radio Waves

Gerald A. Smith*

BA Physics Miami U. (OH) 1957, MS PhD Physics Yale U. 1958 1961
Emeritus Professor of Physics, The Pennsylvania State University Fellow, American Physics Society
Corresponding author at 7175 E. Camelback Rd, apt 109, Scottsdale, AZ 85251
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***Corresponding Author:** Gerald A. Smith, BA Physics Miami U. (OH) 1957, MS PhD Physics Yale U. 1958 1961.

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Abstract
This Letter is a brief and early prospectus for NASA's Europa Clipper. Missions to Jupiter's moon Europa started with Pioneer (1973,74), followed by Voyager (1979) and Galileo (1995-2005). The latest is Europa Clipper that arrived at Europa in May 2025. It features a 3m diameter antenna to send and receive regular radio communications to and from Earth. We highlight their important space physics opportunities, especially involving stable Positronium and its radiation.

Keywords: Positronium, Jupiter, Europa, Magnetic Fields, Pair and Ion Plasmas, Alfven Waves, Double Helix Pair Radiation, Short-Wave Radio

Introduction
Our observation of 44MHz radio waves by western Australian and Eastern Chinese radio telescopes in 2018 coincident with stable Positronium (Ps) atoms riding Alfven waves half way around the globe between Arizona and Easter Is. was important to space physics. The Ps source on Earth was 1μCurie of ^{22}Na. The radio waves were emitted by stable Ps atoms made in the Americas by an artificial positron source with important implications noted in the following reading. As illustrated herein, Ps will pose and answer important new space physics questions.

Our Alfven waves rode Earth's 0.4G magnetic field moving back and forth in circular arcs between Arizona, USA in the northern hemisphere and magnetic conjugate Easter Is. (EI) Chile in the southern hemisphere. Magnetometers on EI recorded long, intermittent intervals of stable Ps zero magnetic susceptibility with a 4d average. The large interval spread presumes unseen quantum structure [1].

The 44MHz frequency was synchrotron radiation from double helix motion of electron-positron pairs circulating on Earth's field within stable Ps atoms. Such radiation has been seen in quasars in small fields emitting small frequencies [2].

Jupiter's Short-Wave Radio Frequency
We expect the same quantum effects in Jupiter's and Europa Clipper's (EC) orbits as seen in Earth's orbit, but with different lifetimes and frequencies. Cosmic ray positrons in Jupiter's dense atmosphere have much larger densities than the weak ^{22}Na on Earth. The equatorial magnetic field is ≈10x that of Earth for a double helix frequency of ≈44MHz·10 = 440MHz. Fig. 1 shows Galileo's radio frequency data on Jupiter. A constant enhancement at the top of Fig. 1 with ≈ 400±40MHz frequency is observed. The 24s exposure was too short to determine lifetime.

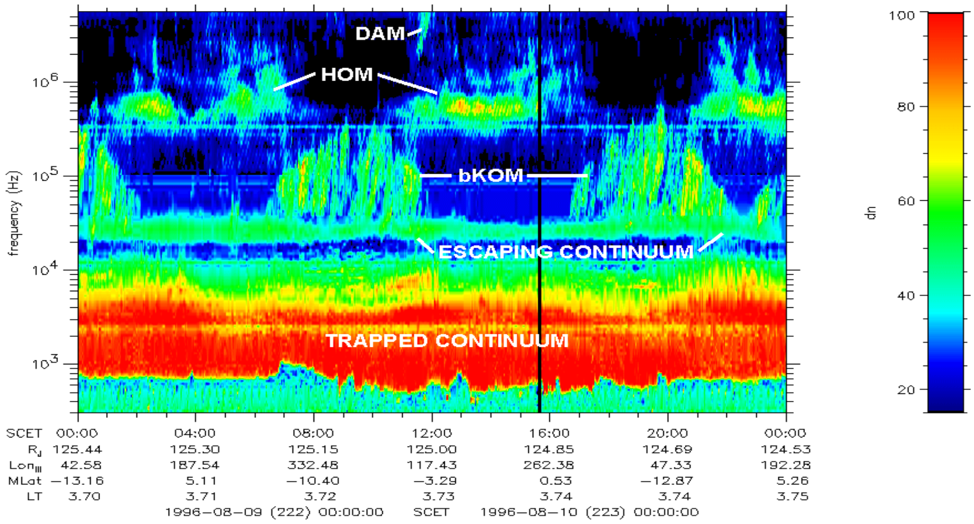

Figure 1: Gamma-Ray Yields at Small Latitudes and a Wide Range of Longitudes on Jupiter (courtesy U. Iowa Space Physics, Galileo Mission, 1996).

Stable Ps lifetime Orbiting Jupiter

The equatorial Jupiter orbital lifetime for $R_J = 4.5x10^8m$, $B \approx 4\cdot10^{-4}T$ and plasma density $\approx 2.5\cdot10^6/m^3$ is $(2\pi\cdot RJ=2.8x10^9m)(v_A= 4\cdot10^{-4}T/\sqrt{4\pi\cdot10^{-7}\cdot2.5\cdot10^6/m^3} = 1.8m/s)\cdot(1d/86,400s) = 58,333d$ (160yr), 14,583 times larger than on Earth and traveling at a very slow velocity, all consistent with Ps theory [3].

This lifetime has an assumed 100% zero classical magnetic susceptibility, but was seen intermittingly broken on Earth [1]. This suggests that our calculated Ps quantum lifetime does not include unaccounted for electron spin effects. It is our recommendation that EC track pairs and gamma-rays emitted from orbits to quantify this effect. New quantum electrodynamics (QED) in space is upon us. For comparison with Earth, we recommend a contemporary information source [4].

Stable Ps lifetime orbiting Europa

Europa is covered with ice with a sea of water beneath that has attracted NASA's attention for its likeness to Earth. Its equatorial parameters are $R_E = 1.6x10^6m$, $B = 10^{-7}T$ and plasma density = $9x10^4m^{-3}$. The lifetime is $(2\pi R_E=9.7x10^6m)(v_A=10^{-7}T/\sqrt{4\pi\cdot10^{-7}\cdot9x10^4/m^3} = 0.34m/s)\cdot[1d/86,400s] = 3.8d$, within errors the same as Earth. The similarity of Ps on Europa and Earth is confirmed. EC can also look for human life millions of years ago in Europa's plasma by comparing its molecular structure with human MRI data [1,5]. The electroweak force presents in its theory single low energy γ-rays vastly outnumbered by double helix annihilation γ-rays.

Conclusions

This Letter points out opportunities for measuring properties of stable Ps orbiting Jupiter and Europa with high statistical accuracy. Long lifetimes and large numbers of Ps decays make it possible to test new quantum electrodynamic (QED) features of Ps in space with accuracy far exceeding Earth. Of particular interest is Ps quantum Ps sub-structure. A special need for all future work is pair and γ-ray tracking data from orbit. If human life existed on Europa millions of years ago, EC may verify it by comparing its plasma with Earth's MRI data [1,5].

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