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## Plasma-embedded positronium atom with energy-dependent potential

By: Bahar, MK (Bahar, Mustafa Kemal) <sup>[1]</sup>

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### Abstract

In this study, for the first time in the related literature, the positronium atom embedded in the plasma environment with energy-dependent potential interaction, under spherical confinement, is investigated. The more general exponential cosine-screened Coulomb (MGECS) potential is used to describe the interaction potential of the positronium atom in the plasma environment. Among four different sets of MGECS potential to model Debye and quantum plasma, the most general form for calculations is considered, and thus, the positronium atom investigated contained energy-dependent potential interaction embedded in the quantum plasma environment. The energy dependence of the interaction potential is chosen linearly and rendered to a tunable case by using a dimensionless parameter. MGECS potential is modified by considering the linear energy dependence. The nonrelativistic spectrum

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and wave functions of the energy-dependent MGECS potential (energy-dependent plasma (EDP) potential) for the positronium atom are obtained using the Runge-Kutta-Fehlberg (RKF) method. The effect of the plasma shielding parameters, the spherical encompassing effect and the energy dependence on generation and control of the orbital charge-currents and the induced magnetic fields of the positronium atom are examined. Furthermore, the transition energies, the oscillator strengths and the dipole polarizability are studied for only energy dependence. For the energy-independent case, the structural property review is also performed, and the results are compared. Alternatives to each other of the effective potential parameters on the charge-currents, the induced magnetic fields and the structural properties are also discussed. The charge-current and induced magnetic field analyses are also performed for energy-dependent potential-plasma environment case, plasma environment-energy-independent potential case, no-plasma environment-energy-dependent potential case, and no-plasma environment-energy-independent potential case.

### Author Information

**Corresponding Address:** Bahar, Mustafa Kemal (corresponding author)

▼ Sivas Cumhuriyet Univ, Fac Sci, Dept Phys, TR-58140 Sivas, Turkey

#### Addresses:

▼ <sup>1</sup> Sivas Cumhuriyet Univ, Fac Sci, Dept Phys, TR-58140 Sivas, Turkey

**E-mail Addresses:** [mussiv58@gmail.com](mailto:mussiv58@gmail.com)

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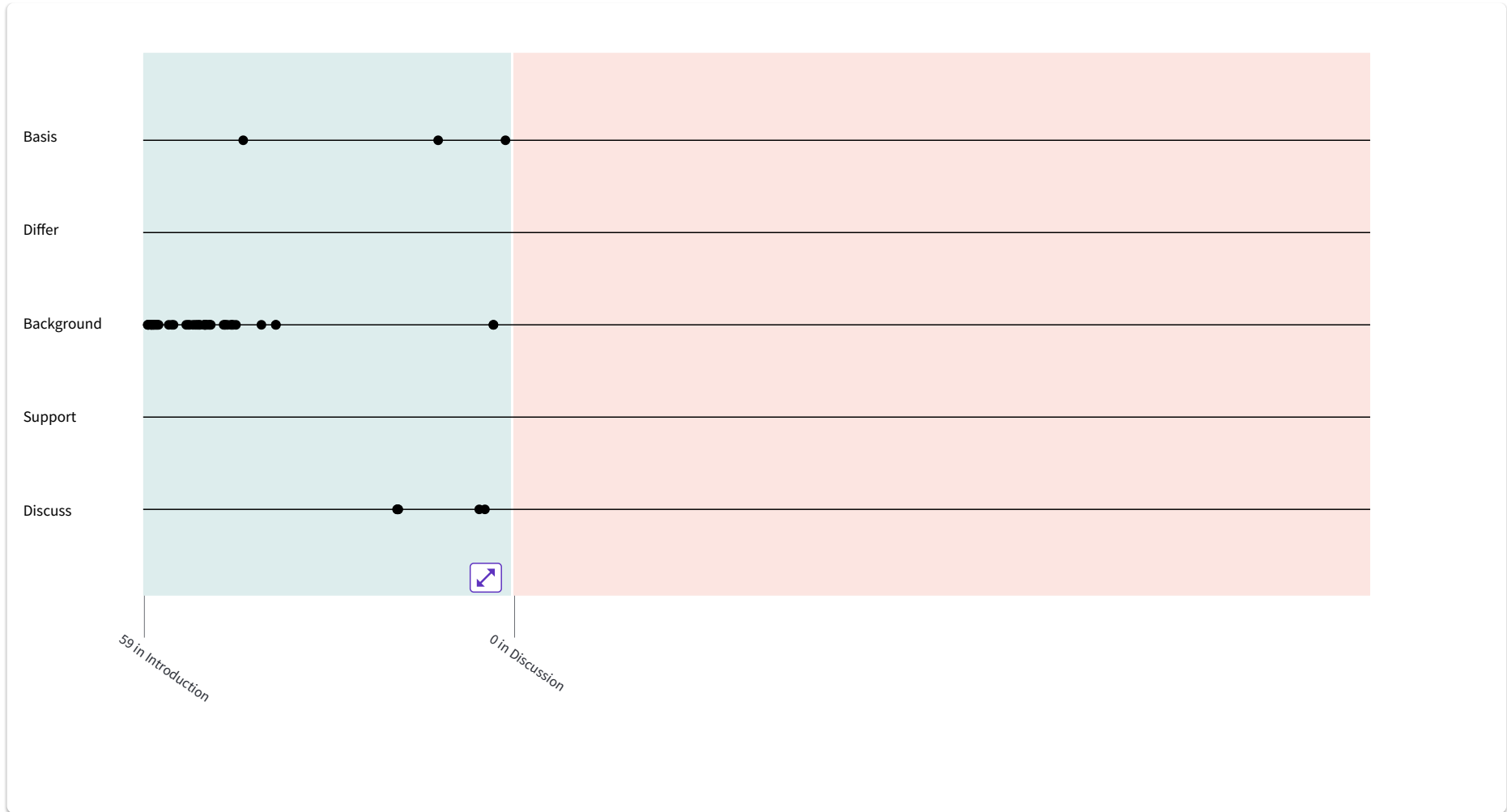
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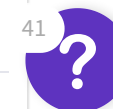
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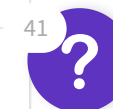
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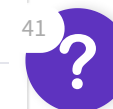
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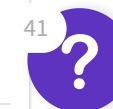
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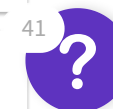
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