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VLT/NACO observations of Neptune's ring arcs

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Abstract

The Neptune's incomplete rings (arcs) have been stable since their discovery in 1984, as these structures should be destroyed in a few months through differential keplerian motion. They are close but not within a 42:43 corotation inclination resonance forced by Galatea, thought to be responsible for the azimuthal confinement of the arc system [1, 2, 3]. Moreover, adaptative optics images obtained in 2002 and 2003 with the Keck telescope showed that the brightness and locations of the arcs in the azimuthal direction changed significantly [4].

Two different theories can solve, at least partly, the question of the arcs' stability:

- if the arcs have a sufficient fraction of the mass of Galatea, a 42:43 corotation eccentricity resonance can match the current arcs' semi-major axis and stabilize the system [5]

- small co-orbital satellites confine the dusty arc material. These hypothetical co-orbital bodies are in a stable stationary configuration equivalent to the Lagrangian points [6, 7]

We present NACO adaptative optics observations of Neptune's ring arcs at 2.2 μm (K band), taken with the VLT-Yepun telescope in August 2007. We give improved mean motion values for the arcs and Galatea, thus confirming the mismatch between the arcs' position and the location of the 42:43 corotation inclination resonance. We compare the photometry of the arcs with previous observations. We finally use the data to constrain the masses and positions of the co-orbital satellites which could confine the arcs, while allowing a slow evolution of the system.

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