Is there a Europa neutral torus?

**Problem**
- Existence of Europa-generated neutral torus (co-orbiting particles) provides key insight into this moon’s composition and activity
- Mauk et al. (2003) reported detection based on Energetic Neutral Atom (ENA) observations produced by charge-exchange interactions
- However, at Jupiter charged particles could charge exchange with other charged particles (and not a neutral torus)

**Research**
- Range of all plasma environments determined
- All charge-exchange interaction rates (with neutral particles and with plasma) calculated
- 3-D models of Europa & Io neutral tori constructed

**Results**
- Europa neutral torus required to explain Cassini/INCA observations ($H_2$ is primary source species)
- Opposite side of orbit: ~15%-69% likely not caused by neutral torus
- Neutrals from Europa dominate its orbit (over those from Io)
- Ambient plasma environment variability can significantly impact particle interaction rates (more than x10)

---

Yes, Europa is producing a neutral torus.

---