JUPITER'S SYNCHROTRON EMISSION INDUCED BY THE COLLISION OF COMET SHOEMAKER-LEVY 9

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From July 13 to August 21, 1994, we observed Jupiter at 1420 MHz with one of the 30-m single dishes of the Instituto Argentino de Radioastronomía. After the impact of fragment G, we detected a rapid increase of the 21-cm continuum flux, which reached the maximum ($\approx 20\%$ of Jupiter's flux) at the end of the impact period and then decayed within 30–60 days. The nature of this radiation is clearly synchrotron. We interpret it in terms of a new population of relativistic electrons ($\approx 10^{29}$ – 10^{31}) injected by the impact explosions into the Jovian magnetosphere. We propose a model in which the energies of the fresh electrons, initially with a power law energy spectrum, were highly degraded by the comet dust grains. The model can account for the spectral shape, based on observations at several frequencies. (de Pater et al. 1995, Science 268, 1879). We propose that the relativistic plasma was blown as magnetic clouds, which diluted in a few days. The energy released by the explosions under the form of relativistic electrons is of $\approx 10^{24}$ – 10^{26} erg, i.e., a small fraction of the total energy liberated by the collisions ($\approx 10^{30}$ erg). We suggest the behavior of the flux decay in the various observed frequencies is the result of the diffusion of electrons into the loss-cone due to the resonant scattering of the electrons by Alfven waves.

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WHY URANUS HAS NO OUTER SATELLITES

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The Jovian planets have a rich system of regular satellites. Jupiter, Saturn, and Neptune besides, have irregular satellites that are associated to a capture origin. There is no apparent reason for explaining why Uranus had not been able to capture irregular satellites, but there are not known, up to date, outer satellites of this planet. The other peculiar characteristic of Uranus is the large obliquity of the rotation axis. For the rest of the Jovian planets this inclination is not greater than 30°, but for Uranus this angle is of 98°. This large obliquity is generally attributed to a rather singular tangential collision with another large protoplanet when presumably Uranus accreted 90–95% of its present mass. It is possible that if the Great Collision took place, it also imparted enough orbital impulse to unbind the orbits of pre-existing distant satellites (Brunini 1995). In this work, we settled dynamical constraints to Uranus' Great Collision in connection with the observational evidence. An unabridged version of this work may be found in Parisi & Brunini (1996). We studied the angular momentum transfer at collision, which allowed us to obtain the incident velocity of the impactor as a function of its mass. It was also possible to obtain an upper limit for this velocity under simplifying energy considerations. In addition, we considered the most probable situation, where the impactor would have been bound to the Solar System. In this case the maximum relative velocity is ~ 31.54 km/s and we obtained that the minimum allowed impactor mass is $\sim 1 - 1.1\, m_{\oplus}$. On the other hand, we studied how the orbits of hypothetical preexisting satellites of Uranus were unbound from the planet, as a consequence of the energy imparted at collision. The relevant result is that any massless particle orbiting beyond $\sim$ 70–90 planetary radii was probably swept out from the system, and so, it is hardly expected the existence of outer satellites of the planet (if the Great Collision ever occurred). A further intensive search for very faint outer objects orbiting Uranus beyond 70 planetary radii would provide a constraint to the Great Collision scenario.

Brunini, A. 1995, Planet. Space Sci., in press
Parisi, M.G., & Brunini, A. 1996, Submitted to Planet. Space. Sci.

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SOLAR OBSERVATIONS: DETERMINATION OF THE FUNDAMENTAL SYSTEM AND THE ORBITAL ELEMENTS

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A set of 12450 observations of the sun limbs, obtained by the modified astrolabes of the Observatoire de la Côte d'Azur (OCA), of the Observatório Abrahão de Moraes (OAM/IAG) and of the Observatório Nacional (ON), from 1974 to 1992, was analyzed in order to determine the origin of the fundamental reference system and the earth's orbital parameters.

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