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W.P. Chen, C. Lemme, B. Paczyński

Project MONICA for the Study of Time-Variable Phenomena of the Jovian Sodium Cloud and the Io Plasma Torus

Chien-Pang Chang and Wing Ip

Institute of Astronomy, National Central University, Chung-Li 32054, Taiwan

Abstract. Because of active volcanism, large amounts of gas and dust particles are being injected from the Galilean satellite, Io, into the Jovian system. The neutral cloud of sodium atoms and the plasma torus of sulfur ions provide very useful information on Io's interaction with the Jovian magnetosphere. A program called MONICA (Monitoring of Neutral and Ionized Atoms Clouds) was established at NCU with a view to participate in an international campaign during the flyby of the Jovian system by the Cassini spacecraft in December, 2000. Spectrographic observations were carried out using the 2.16m spectrograph of the Beijing Astronomical Observatory in Xing-Long. A progress report is presented here.

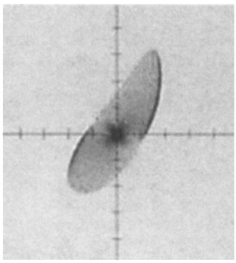
1. The Atomic Sodium Cloud and Jets

As a result of surface sputtering by the Jovian energetic ions, Io emits a large quantity of atmospheric gas (SO_2 and Na) into the circumplanetary region. From ground-based observations, it is known that there is a banana-shaped sodium cloud composed of slow-moving atoms with a relative velocity of 2$\sim$3 km/s with respect to Io (Brown, 1974; Goldberg et al., 1984). High spatial resolution imaging observations have also shown the presence of a narrow sodium jet moving at a speed of a few tens km/s (Pilcher et al., 1984; Schneider et al., 1991). This fast atomic beam might be produced by direct atmospheric interaction of the Na^+ ions in the Jovian magnetosphere. These fast atoms in turn create a giant sodium nebula surrounding the Jovian system (Mendillo et al.,1990); see Fig. 1.

2. Observational Method and Preliminary Results

In order to provide scientific input to the international Cassini Jupiter Flyby campaign in December 2000, we have acquired several nights (December 16, 18 and 25) of observations on the 2.16 m spectrographic telescope for Io observations. Some of the preliminary results are shown below in Figure 2.

With proper subtraction of the continuum background produced by the scattered light of Io's disk, the spectrographic images taken at different slit positions can be used to construct a 2D image of the atomic sodium cloud. The spatial distribution so derived would be useful in estimating the production rate of sodium atoms in the fast jet during the observational time interval.



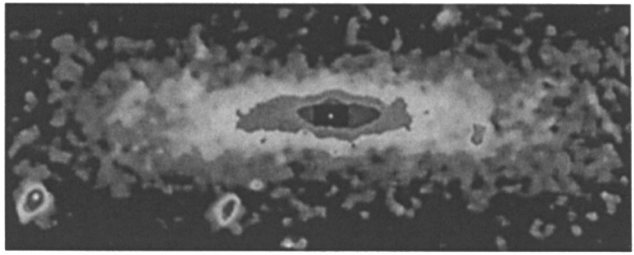
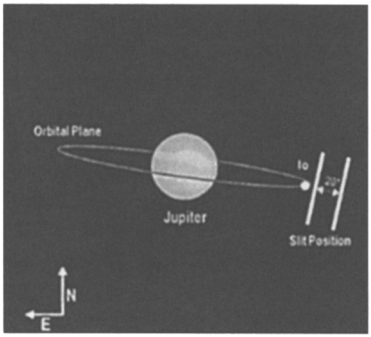


Figure 1. The left-hand-side picture depicts the banana-shaped sodium cloud moving with a velocity of about 2~3 km/s. This figure is a 2D N-body simulation result. If the ejection velocity of particles is greater than about 7 km/s, the escaping atoms will form a giant sodium nebula surrounding Jupiter. The right-hand-side picture was taken form Mendillo et al. (1990)



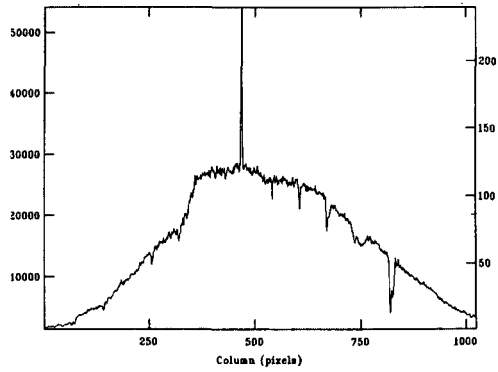


Figure 2. The left-hand-side figure shows the position of the slit of the BAO observations. A strong sodium D-line emission can be seen superimposed on the continuum. There spectra can be used to build a 2D image of the sodium cloud.

References

Brown, R.A. 1974, IAU Symposium No. 65, Exploration of the Planetary System, p.527

Goldberg, B. A., Garneau, G. W., Lavoie, S. K. 1984, Science **226**, 512

Mendillo, M., Baumgardner, J., Flynn, B., and Hughes, W.J. 1990, Nature **348**, 312

Pilcher, C.B., Smyth, W.H., Combi, M.R., and Fertel, J.H. 1984, ApJ **287**, 427

Schneider, N.M., Hunten, D.M., Wells, W.K., Schultz, A.B., and Fink, U. 1991, ApJ **368**, 298

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