Deuterium abundances in the nearby heliosphere

S. Tarnopolski, **M. Bzowski**

Space Research Centre PAS, Bartycka 18A, 00-716 Warsaw, Poland

Deuterium was formed during the initial phase of the Big-Bang and since this time is subject to astration losses, without any significant gains, because post-Big-Bang deuterium production requires extremely exotic and violent events. Hence accurate measurements of deuterium abundances are important for understanding chemical evolution of the Galaxy and early history of the Universe. Studies of neutral interstellar gas in the inner heliosphere can yield an independent measurement of the abundance of deuterium in our region of the Galaxy, providing, however, that transport effects from the Local Cloud to the detector are appropriately accounted for. Neutral atoms from the Local Interstellar Cloud enter the heliosphere due to the relative motion of the Sun with respect to the ambient interstellar gas. The motion of neutral atoms inside the heliosphere is governed on one hand by solar gravity and on the other hand (in the case of hydrogen and deuterium) by radiation pressure in the solar Lyman-alpha line. The radiation pressure acting on deuterium atoms is quite different than on hydrogen because of atomic mass difference and of the isotope effect, which shifts the deuterium Lyman-alpha frequency blueward by 0.333 A to the area of the blue peak of the self-reversed solar Lyman-alpha line profile. In effect the radiation pressure acting on deuterium atoms strongly depends on radial velocity. We expand the Warsaw test-particle model of heliospheric gas distribution with a newly-developed, observation-based model of the wavelength-dependent radiation pressure, parametrized by the line-integrated Lyman-alpha flux. Using this model, we calculate expected densities and fluxes of interstellar hydrogen and deuterium in the nearby heliosphere during various phases of solar activity. We find out that deuterium abundance in the inner heliosphere will be strongly increased with respect to the abundance at the termination shock. The abundance excess increases towards the Sun and is a strong function of the offset anggle from upwind. We show also D/H ratios of pickup ions and Energetic Neutral Atoms and discuss perspectives of in-situ detection of neutral interstellar deuterium by the planned Interstellar Boundary Explorer (IBEX) mission.