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Interstellar D/H ratio in the inner heliosphere modified by the radial-velocity dependent radiation pressure

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Deuterium is the tracer of the primordial baryon density. It was created within 3 – 15 minutes after the Big Bang and – as the only element in the Universe – is subject to astration-only processes: no significant process of deuterium synthesis has been recognized. Hence studying its local abundances we can conclude on the processing the matter has undergone. Measuring deuterium abundance within the LIC by interstellar spectroscopy is possible with limited accuracy only and an independent method would be welcome. Since its abundance in the LIC is as much as about 1/25 of oxygen, it should be detectable inside the heliosphere in a near future. Since neutral interstellar gas is subject to filtration in the heliospheric interface, such a measurement would be meaningful when compared with measurements of hydrogen. We show that although hydrogen and deuterium ionization rates are practically identical, the D/H ratio is significantly modified in the inner solar system by dynamical effects induced by radiation pressure from the solar Lyman-alpha line. The atomic mass of deuterium atom is almost twice the mass of hydrogen, which should reduce the radiation pressure by half. However, due to isotope effects the wavelength of the deuterium line is blue-shifted by 0.333 A, which places it in the area of the blue peak of the self-reversed solar Lyman-alpha line profile, at its slope. In consequence the radiation pressure is strongly dependent on radial velocity and it differs from the radiation pressure on hydrogen by a variable factor. We use the newly-available observations of the solar Lyman-alpha profile during solar cycle and the Warsaw test-particle model of heliospheric gas distribution, expanded to take into account the radial velocity dependence of radiation pressure, to calculate expected densities and fluxes of interstellar D and H in the heliospheric locations available for in situ measurements during various phases of solar activity. We show expected modifications of the D/H abundance due to heliospheric effects and D/H ratios of pickup ions and Energetic Neutral Atoms.