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Anisotropic gas emission and non-uniform density distribution in a cometary coma

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In comets the anisotropic gas emission from their nuclei have been discovered in gas jets, fans, close-up images of cometary nuclei provided by missions, asymmetric shapes of the cometary gas production curves with respect to perihelion, asymmetric non-gravitational forces perturbing the cometary orbits and finally in the spectral imaging of comets in the molecular lines. The evidence of anisotropic outgassing of comets may be interpreted with models of non-uniform distribution of activity. The proposed axisymmetric model of the outgassing is based on (i) a non-uniform density distribution and (ii) the Couple Escape Probability (CEP) method for treating radiation transfer. The spatial and temporal distribution of activity depends on two different approach to the solar input. The enhanced gas flow related to the discrete active area is accompanied by some emission of uniformly distributed material. The gas density profile is described by a density function that vary as a function of the angle with respect to the outgassing axis. It is shown that the gas density distribution influences the absorption and emission signal in the line profile and its shape. Effects of the physical parameters of the cometary material like density, temperature, and expansion velocity on the line intensity are discussed. The synthetic line profiles and maps of water emission are constructed under assumption of various forms of the density function.

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