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Effect of the equation of state on the planet migration

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Planet migration has been extensively studied analytically and numerically under the two assumptions of an infinitely thin and vertically isothermal disk. These two hypotheses deserve to be questioned. We perform 3D SPH simulations of a protoplanetary disk with a 1 Jupiter mass embedded planet initially located at 5 AU and free to move in response to the disk torques. We use the code GASOLINE with either a vertically isothermal equation of state or an adiabatic one but with including shock heating. Then we perform new simulations in the flux limited diffusion approximation. We find that the planet migrates much more slowly inwards in the adiabatic case than in the isothermal one. We conclude that a more realistic treatment of the energy equation is required in order to properly describe the planet migration and this could be part of the solution to the too high migration rate problem for planet formation.