# Numerical Simulations of Dust Circulation in Protoplanetary Disks

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We perform numerical simulations of the radial circulation of dust particles in weak turbulent protoplanetary disks, taking the effect of radiation pressure of the central star and puffed-up inner rim of the disk into account. We confirm that the following dust circulation mechanism will be realized: at the inner edge of the disk, infalling dust aggregates partially evaporate and break up into fine grains, which are stirred up to the upper irradiated region by convection and are blown outward by the radiation pressure. Most of the blowing grains reenter into the disk within about 1AU

and settle to the midplane, joining inwardly-migrating dust aggregates. We find that in the shadowed region the outflow mass flux in the surface layer is comparable to the inflow mass flux in the disk interior,

i.e. dust circulation is realized. Further, the outflow flux of the surface layer becomes a quasi-steady state for short time scale. In consequence, we calculated the steady surface density of particles and found that the dust fall problem is solved by the dust circulation at the inner shadowed region of disks.