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AN ACCRETION DISK MODEL FOR THE INNERMOST 200PC OF THE GALAXY

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ABSTRACT We demonstrate that it is possible to understand observed radial velocities of molecular clouds close to the Galactic Center as being due to motion of this material in an accretion disk. Our models indicate a stationary disk with a radial mass flow rate of $10^{-1.8}$ $M_\odot$/yr with a viscosity of $1.9 \cdot 10^3$ pc km/s at 100 pc from the Galactic Center and a radial dependence of it, that goes approximately like the square root of the radius from the Galactic Center.

MODEL

Observations give two geometrical coordinates (galactic longitude and latitude) and one component of the velocity vector (radial velocity). One needs a physical model for the dynamics or the observed matter in order to gain information about the other two velocity components and, especially, the third geometrical coordinate. In our model, we assume that the overall flow patterns close to the Galactic Center (GC) are well described in the framework of an accretion disk picture. We interpret the molecular clouds as being prominent tracers of the local velocities. As we restrict our analysis to accrection disks that are geometrically thin in the direction perpendicular to its rotation plane, we do not resolve this direction. In this way, only four of the orginally six dimensions of phase space are dealt with in our analysis. We allow for a non stationary disk with radially variable viscosity. The disk is assumed to evolve in the gravitational potential of a sperically symmetric but not necessarily point-like mass distribution. For this mass distribution, we use the values as given by Genzel and Townes (1987, *Ann.Rev.Astron.Astrophys.* **25**, 377). In the case of non-negligible self-gravity in the disk, we take star formation into account; stars formed out of the disk are assumed to decouple from the disk and thus do no longer contribute to the accretion. Further details of the models are described elsewhere (Linden, Duschl, and Biermann, 1992, *Astron.Astrophys.*, in press).

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OBSERVATIONS

For our models, we use the ^{13}CO observations of the molecular cloud M-0.13-0.08 (Zylka *et al.*, 1990, *Astron.Astrophys.* **234**, 133) and H_2CO observations ot the -190 km/s features on either side of the GC (Pauls *et al.*, 1992, *Astrophys.J.*, in press). The set encompasses altogether nine observations. Our aim is to determine the missing geometrical coordinate from this position-velocity observations with the help of the accretion disk model. Moreover, this will give us information about the physical conditions in the GC accretion flow.

RESULTS

We find that the observations are best explained by modelling it with a stationary accretion disk with a radial mass flow rate of $10^{-1.8}$ $M_\odot$ /yr. Additional vertical mass infall into the disk does not improve our solutions, but we cannot exclude it as long as its total rate (integrated over the entire disk) is small compared to the aforementioned rate. For the viscosity we find a value of $1.9 \cdot 10^3$ pc km/s at a radius of 100 pc from the GC. Its radial variation is proportional to $s^{0.45}$ (s: radial distance from the GC). While the value of the viscosity is very high compared to what a standard accretion disk (Shakura and Sunyaev, 1973, *Astron.Astrophys.*, **24**, 337) would give, it is in good agreement with observed velocity dispersion and scale height. This topic is addressed in detail by Linden, Biermann, Lesch, Schmutzler, and Duschl (1992, submitted to *Astron.Astrophys.*) and by Biermann, Duschl, and Linden (1992, submitted to *Astron.Astrophys.*). Disks with these parameters are not self-gravitating; thus star formation does not play an importent rôle. We find that viscosity and mass flow rate are the two most important parameters for our models. This allows to determine both parameters very accurately (much better than half an order of magnitude). In our models, M-0.13-0.08 is found to be located 115 pc from the GC on the near side. The -190 km/s features lie at a GC radius of 10...15 pc on the far side.

CONCLUSIONS

It is justified to use molecular clouds as tracers of the flow pattern close to the GC. An accretion disk model gives a good representation of the observations. We regard this result as a first step towards mapping the GC region.

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