ACCRETION OF GAS BY STARS IN GLOBULAR CLUSTERS

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One of the two classes of models that have been proposed for the production of X-rays in globular clusters involves accretion of gas by a more or less massive (10 $M_\odot$ - 1000 $M_\odot$) black hole at cluster centre (Cowie, Ostriker and Stark 1978 - COS). The accretion rates are not large ($\sim 10^{17}$ g s^{-1}), and we may enquire how such rates compare with those for accretion on cluster stars in general.

Since accretion rate is a sensitive function of stellar mass and velocity, the total rate involves a summation over both these quantities. To obtain a preliminary rate estimate the two quantities may be treated as separable; we first define an "effective stellar mass for accretion" (based on the Salpeter luminosity function), and then integrate over the stellar velocity distribution in a King cluster model with parameters matching the most tightly bound of actual globulars. COS propose two possible X-ray models, one incoporating a $\sim$ 10 $M_\odot$ black hole in a gaseous medium of number density 3 x 10^4 cm^{-3}, the other a 100 - 1000 $M_\odot$ black hole in a medium at 10 cm^{-3}. If these densities are uniform within the cluster core radius, we find that the first model would involve an accretion rate onto stars (within the core) 300 times larger than that onto the black hole. The second model would have stellar accretion 10 times smaller than that on the black hole.

Because of the sensitivity of accretion rate to stellar velocity, up to 25% of the stellar accretion occurs onto the slowest moving 2% of the stars. For stars near the bottom of the velocity distribution at cluster centre this can result in an appreciable build-up of mass (several percent) in times which are comparable with those applying for stellar encounters which may remove such stars from the centre. We explore the possibility that a collapsed

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seed object of $\sim 2\ M_\odot$ (resulting from supernova explosion of a former cluster member) could accrete sufficient gas from a medium with density 3×10^4 cm^{-3} over the life of a cluster to become the $10\ M_\odot$ black hole presently responsible for the X-rays on the first COS model. The chances of this happening seem sufficiently high to warrant a more detailed calculation.

REFERENCES

Cowie, L.L., Ostriker, J.P., and Stark, A.A.: 1978, *Astrophys. J.* *226*, 1041.

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