THE RADIO SPECTRUM OF SGR A*

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Sgr A*, the enigmatic radio source located at the dynamical center of the Galaxy, is firmly detected in the frequency range of $\sim 1 -$ few 10^2 GHz. For $\sim 0.5 - 1$ GHz and in the MIR range only significant upper limits of the flux density are known. Between ~ 1.5 and 600 GHz the time averaged flux density S_ν is proportional to $\nu^{1/3}$ (ν: frequency). For frequencies higher than ~ 600 GHz as well as for those lower than ~ 1.5 GHz, S_ν drops sharply.

The radio spectrum can be understood as optically thin synchrotron radiation assuming a single homogeneous blob of relativistic electrons placed in a homogeneous magnetic field. The form of the spectrum imposes strict limits on the energy distribution of the electrons. The most important features of the distribution function $f(E)$ (E: energy) are high and low energy cut-offs. While the low energy cut-off must fulfil $f(E) \to 0$ for $E \to 0$, the cut-off at high energies must be steeper than exponential and thus excludes thermal relativistic electrons. The emitted spectrum of distributions meeting these conditions is independent of the detailed form between the low and high cut-off, thus establishing a class of quasi-monoenergetic electron distributions, all producing similiar synchrotron spectra. Assuming the source to be a spherical homogeneous blob, the turnover of the spectrum at ~ 1 GHz can be due to selfabsorption inside the source. Another explanation for the turnover is free-free-absorption in the surrounding hot gas of the central cavity. Both processes must occur. They provide an upper limit for the column density in Sgr A West of $N_H \sim 4.3 \cdot 10^{21} \mathrm{cm}^{-2}$ and a lower limit for the size (radius) of Sgr A* of $R \geq 1.2 \cdot 10^{13}$ cm.

References

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