Sgr A* radiation spectrum

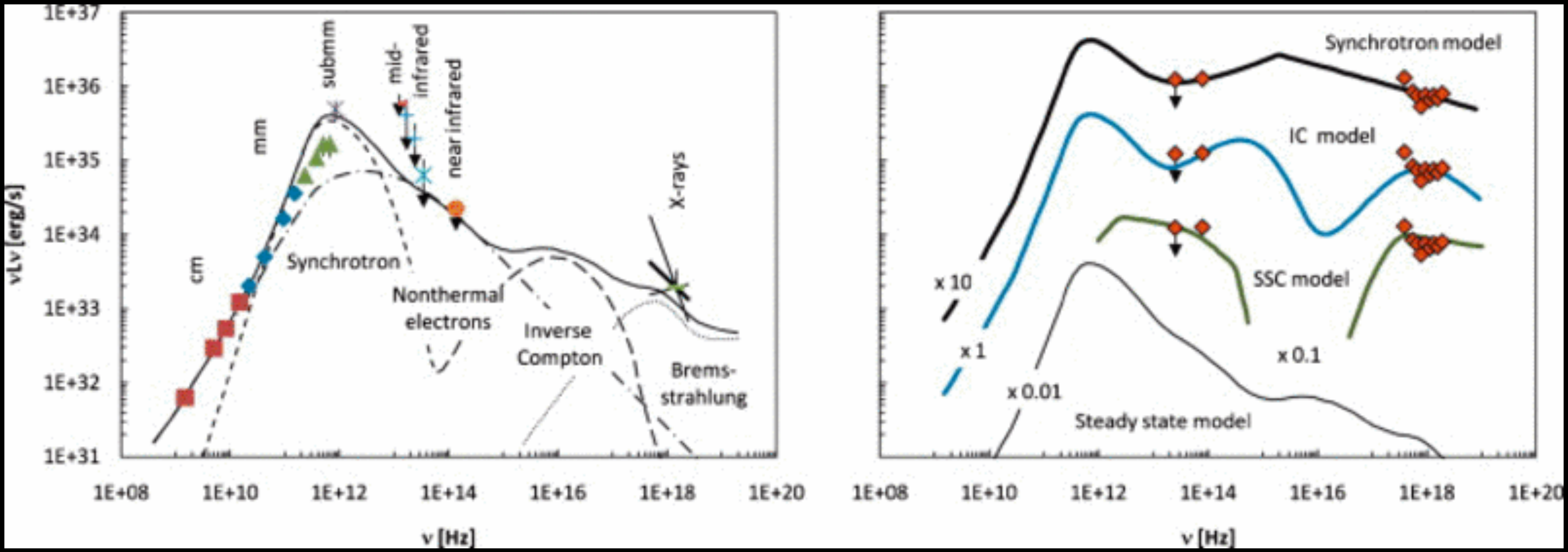


Figure 30(Color) Spectral energy distribution of Sgr A*. All numbers are given for a distance of 8.3kpc of the Galactic Center and are dereddened for interstellar absorption (infrared and x rays) and scattering (x rays). Left: steady state. The Sgr A* radio spectrum follows roughly a power law vLv~v4⁄3. The observed peak flux at submillimeter wavelengths is about 5×1035erg⁄s. The spectrum then steeply drops toward infrared wavelengths down to less than the detection limit of about 2×1034erg⁄s at 2μm. The only other unambiguous detection of Sgr A* in its steady state is at x rays with energies from 2–10keV with a flux of about 2×1033erg⁄s. The figure shows a compilation of data (with increasing frequency) from ■ (560), ◆ (150), ▲ (565), × (487), - (105), + (186), × (475), ● (243), and – (34). Overplotted is a model of the quiescent emission [adapted from 541]: the radio spectrum is well described by synchrotron emission of thermal electrons (short-dashed line). The flattening of the radio spectrum at low frequency is modeled by the additional emission from a nonthermal power-law distribution of electrons, which carry about 1.5% of the total thermal energy (dash-dotted line). The quiescent x-ray emission arises from thermal bremsstrahlung from the outer parts of the accretion flow (dotted line). The secondary maximum (long-dashed line) at frequencies of about 1016Hz is the result of the inverse Compton upscattering of the synchrotron spectrum by the thermal electrons. Right: SED during a simultaneous x ray and infrared flare: while the total

1. Solve for the fields

- In electromagnetic PIC codes, only two equations need to be solved.

$$\partial_t B = -\nabla \times E,$$
$$\partial_t E = \nabla \times B - J.$$

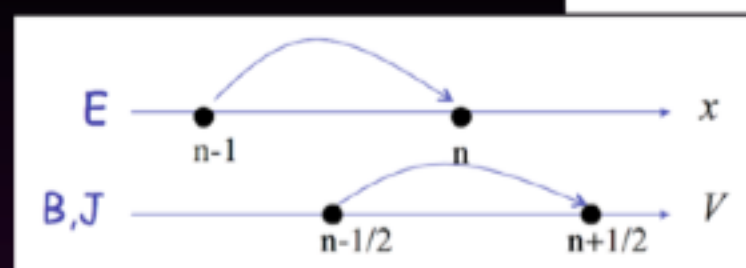
- The other two are satisfied as initial conditions, and they continue to be satisfied for appropriate choices of the numerical scheme.

$$\nabla \cdot E = \rho,$$
$$\nabla \cdot B = 0.$$

STAGGERING in time (leapfrog):

- second-order accurate in time

$$E^{n+1/2} = E^{n-1/2} + \Delta t[c(\nabla \times B^n) - 4\pi J^n]$$
$$B^{n+1} = B^n - c\Delta t \nabla \times E^{n+1/2}.$$



STAGGERING in space (Yee's mesh):

- electric fields on cell edges, magnetic fields on cell faces
- second-order accurate in space
- maintains divergence-free B

$$\partial_t B = -\nabla \times E,$$
$$\partial_t E = \nabla \times B - J$$