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Constraints on turbulent pressure in the X-ray halos of giant elliptical galaxies from resonant scattering

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Abstract. The dense cores of X-ray emitting gaseous halos of large elliptical galaxies with temperatures below about 0.8 keV show two prominent Fe XVII emission features, which provide a sensitive diagnostic tool to measure the effects of resonant scattering. We present here high-resolution spectra of five bright nearby elliptical galaxies, obtained with the Reflection Grating Spectrometers (RGS) on the XMM-Newton satellite. The spectra for the cores of four of the galaxies show the Fe XVII line at 15.01 Angstrom being suppressed by resonant scattering. The data for NGC 4636 in particular allow the effects of resonant scattering to be studied in detail. Using deprojected density and temperature profiles for this galaxy obtained with the Chandra satellite, we model the radial intensity profiles of the strongest resonance lines, accounting for the effects of resonant scattering, for different values of the characteristic turbulent velocity. Comparing the model to the data, we find that the isotropic turbulent velocities on spatial scales smaller than about 1 kpc are less than 100 km/s and the turbulent pressure support in the galaxy core is smaller than 5% of the thermal pressure at the 90% confidence level, and less than 20% at 99% confidence. Neglecting the effects of resonant scattering in spectral fitting of the inner 2 kpc core of NGC 4636 will lead to underestimates of the chemical abundances of Fe and O by about 10-20%.

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