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A multi-site campaign to measure solar-like oscillations in Procyon. II. Mode frequencies

T. R. Bedding, H. Kjeldsen, T. L. Campante, T. Appourchaux, A. Bonanno, W. J. Chaplin, R. A. Garcia, M. Martic, B. Mosser, R. P. Butler, H. Bruntt, L. L. Kiss, S. J. O'Toole, E. Kambe, H. Ando, H. Izumiura, B. Sato, M. Hartmann, A. Hatzes, C. Barban, G. Berthomieu, E. Michel, J. Provost, S. Turck-Chieze, J.-C. Lebrun, J. Schmitt, J.-L. Bertaux, S. Benatti, R. U. Claudi, R. Cosentino, S. Leccia, S. Frandsen, K. Brogaard, L. Glowienka, F. Grundahl, E. Stempels, T. Arentoft, M. Bazot, J. Christensen-Dalsgaard, T. H. Dall, C. Karoff, J. Lundgreen-Nielsen, F. Carrier, P. Eggenberger, D. Sosnowska, R. A. Wittenmyer, M. Endl, T. S. Metcalfe, S. Hekker, S. Reffert

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We have analyzed data from a multi-site campaign to observe oscillations in the F5 star Procyon. The data consist of high-precision velocities that we obtained over more than three weeks with eleven telescopes. A new method for adjusting the data weights allows us to suppress the sidelobes in the power spectrum. Stacking the power spectrum in a so-called echelle diagram reveals two clear ridges that we identify with even and odd values of the angular degree (l=0 and 2, and l=1 and 3, respectively). We interpret a strong, narrow peak at 446 muHz that lies close to the l=1 ridge as a mode with mixed character. We show that the frequencies of the ridge centroids and their separations are useful diagnostics for asteroseismology. In particular, variations in the large separation appear to indicate a glitch in the sound-speed profile at an acoustic depth of about 1000 s. We list frequencies for 55 modes extracted from the data spanning 20 radial orders, a range comparable to the best solar data, which will provide valuable constraints for theoretical models. A preliminary comparison with published models shows that the offset between observed and calculated frequencies for the radial modes is very different for Procyon than for the Sun and other cool stars. We find the mean lifetime of the modes in Procyon to be 1.29 +0.55/-0.49 days, which is significantly shorter than the 2-4 days seen in the Sun.

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