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Lifetime-limited Coherence Between Two $^{27}Al^+$ Clocks using Correlation Spectroscopy[1] ETHAN CLEMENTS, MAY KIM, NIST Boulder/CU Boulder, KAIFENG CUI, NIST Boulder/Argonne National Laboratory, AARON HANKIN, SAMUEL BREWER, JWO-SY CHEN, DAVID LEIBRANDT, NIST Boulder/CU Boulder, DAVID HUME, NIST Boulder — In optical clock comparisons, measurement stability is often limited by the coherence time of the local oscillator. Correlation spectroscopy is a technique for performing frequency measurements between two atomic clocks with an interrogation time beyond this limit[1-3]. By interrogating with the same local oscillator and measuring correlations in the atomic states, the common-mode phase noise of the local oscillator is removed. Here, we demonstrate correlation spectroscopy between two independent $^{27}Al^+$ optical clocks. We observe coherence between the two systems (operating at a frequency of 1.121 PHz) with interrogation times up to 8s, beyond the capability of state-of-the-art cavity-stabilized lasers[4]. This increase in the interrogation time requires active control of differential noise sources such as magnetic field noise and optical-path-length fluctuations. We obtain a fractional comparison measurement instability below $4 \times 10^{-16}/\sqrt{\tau}$ where τ is the averaging time, a factor of $\sim$10 improvement from previous Al^+ clock comparisons. [1]M. Chwalla et al., APB, 89, 483, (2007) [2]S. Olmschenk et al., PRA, 76, 052314, (2007) [3]C.W. Chou et al., PRL, 106, 160801, (2011) [4]D.G.Matei et al., PRL, 118, 263202, (2017)

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