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Near-threshold states in coupled $DD^* - D^*D^*$ scattering from lattice QCD

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The first determination of doubly-charmed isospin-0 coupled-channel $DD^* - D^*D^*$ scattering amplitudes from lattice QCD is presented. The finite-volume spectrum is computed for three lattice volumes with a light-quark mass corresponding to $m_\pi \approx 391$ MeV and is used to extract the scattering amplitudes in $J^P = 1^+$ via the Lüscher quantization condition. By analytically continuing the scattering amplitudes to complex energies, a T_{cc} pole corresponding to a virtual bound state is found below DD^* threshold. We also find a second pole, T'_{cc} , corresponding to a resonance pole below the kinematically closed D^*D^* channel, to which it has a strong coupling. A non-zero coupling is robustly found between the S -wave DD^* and D^*D^* channels producing a clear cusp in the DD^* amplitude at the D^*D^* threshold energy. This suggests that the experimental T'_{cc} should be observable in DD^* and D^*D^* final states at ongoing experiments.

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