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First study of $N_f = 2 + 1 + 1$ lattice QCD with physical domain-wall quarks

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Using a cluster of Nvidia DGX-1 (8*V100 interconnected by the NVLink), TWQCD Collaboration has generated the first gauge ensemble of $N_f = 2 + 1 + 1$ lattice QCD with physical domain-wall quarks, on the $L^3 \times T = 64^3 \times 64$ lattice with lattice spacing $a \sim 0.064$ fm ($L > 4$ fm, and $M_\pi L > 3$). The gauge ensemble constitutes of ~ 200 gauge configurations, resulting from ~ 1000 HMC trajectories by sampling one configuration every 5 trajectories. The salient features of the HMC simulation are: to preserve the chiral symmetry to high precision, and to sample all topological sectors ergodically. In this talk, I will outline the HMC simulation and the generation of the gauge ensemble. Moreover, I will present the first physical results (e.g., the mass spectra of charmed mesons and baryons) from this $N_f = 2 + 1 + 1$ gauge ensemble with physical domain-wall quarks.

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