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Pure and semi-leptonic decays of D(s) at BESIII

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The world's largest e^+e^- collision samples at $E_{cm} = 3.773, 4.009, 4.178,$ and 4.6 GeV have been accumulated at BESIII. By analyzing the decays of $D(s)^+ \rightarrow l^+ \nu$ ($l = \mu, \tau$) and $D(s)^+ \rightarrow (P/V) l^+ \nu$ ($l = e, \mu$), we report the determinations of CKM matrix elements $|V_{cs(d)}|$, the $D(s)^+$ decay constants $f_{D(s)^+}$, the form factors $f_{K/\pi}^{D(s)^+}$ of D semi-leptonic decays. These are important to calibrate the LQCD calculations of $f_{D(s)^+}$ and $f_{K/\pi}^{D(s)^+}$ and to test the CKM unitarity, and determine the η - η' mixing angle.

In the partial wave analysis of the decay $D^+ \rightarrow K^- \pi^+ e^+ \nu$, we find that the dominant $\bar{K}^*(892)^0$ component is accompanied by an S-wave contribution. This analysis also allows us to extract the helicity basis form factor of the resonance in a model-independent way.

Also, for the first time, we search for $D^+ \rightarrow \gamma e^+ \nu$ and $D^+ \rightarrow D_0 e^+ \nu$ as well as for $D \rightarrow a_0(980) e^+ \nu$.

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