Haiyan Gao was born in Shanghai, China. She received her B.S. degree from Tsinghua University in 1989 and Ph.D. in Physics from Caltech in 1994. She was a Postdoctoral Research Associate at the University of Illinois, Urbana-Champaign from 1994-1996 and then joined the staff at the Argonne National Laboratory in 1996. She became an Assistant Professor of Physics at MIT in 1997 and was promoted to Associate Professor in 2002. She joined the Physics faculty of Duke in 2002 and became a full Professor in 2008. She was named Henry Newson Professor of Physics in 2012 at Duke. From 2006-2009, she was the Associate Chair for Teaching in Physics at Duke, and was the Chair of the department from 2011 to 2014. In January 2015, she became the Vice Chancellor for Academic Affairs at the Duke Kunshan University.

Her research interests cover structure of the nucleon, search for QCD exotics, fundamental symmetry studies at low energy to search for new physics beyond the Standard Model of electroweak interactions, and the developments of polarized targets. She received a number of awards including the Chang Jiang Chair Professor at Tsinghua University, Ministry of Education of China (2009-2012); Fellow of the American Physical Society (2007); Overseas Outstanding Young Scholar Collaborative Award, National Natural Science Foundation of China (2005-2008); Outstanding Junior Investigator, Department of Energy (2000). She has published over 100 papers in peer-reviewed journals, and has given more than 200 invited conference talks, seminars and colloquia. She chaired and co-chaired many workshops and conferences, has served on many international advisory committees and panels, and a number of editorial boards of journals.