MARKUS KLUTE: Hello. Welcome back to 8.701. In this short video, we will talk about charge conjugation.

Charge conjugation is the transformation which switches all particles to their corresponding antiparticles and vice versa. So you have a particle p, you apply charge conjugation on this particle, and you receive its antiparticle.

This changes all signs of internal quantum numbers-- the charge, the baryon number, the lepton number, strangeness, charmness, and so on. But at leaves the mass, the energy, the momentum, and the spin untouched. The electromagnetic and strong interactions, they obey charged symmetry. But the weak interaction violates charge symmetry.

So charge conjugation, it's a multiplicative quantum number, like parity. You get identity if you apply charge conjugation twice. You make an antiparticle, and then you apply this to the antiparticle, you get the particle back. Only particles that are their own antiparticles can be eigenstates of this symmetry.

You can see this here. When you apply this, you either get a positive or negative sign. But this is only valid for particles who are their own antiparticles.

As elementary particles, that only leaves the photon. As composite particles, you will see later that there is a number of mesons which can be their own antiparticles. But we'll discuss this in subsequent lectures.

By itself, there's limited use to the symmetry in order to learn things. There are some examples, and we'll discuss them in a recitation, where you can learn about possible decays, for example, in pions, neutral pions, from applying this symmetry, without knowing really what is the underlying physics. But in the next lecture, we then talk about CP, the multiplication of parity and charge conjugation, and some of the interesting effects which occur from this.