Ξ Resonances

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Most of our present knowledge of Ξ resonances stems from the low-statistics data samples recorded in the 1960s–1980s using K^- beams and in the 1980s and 1990s using hyperon (Σ^-, Ξ^-) beams. This is because (1) they could only be produced as a part of a final state, and so the analysis is more complicated than if direct formation were possible, (2) the production cross sections are small (typically a few μb), and (3) the final states are topologically complicated and difficult to study with electronic techniques. Thus, early information about Ξ resonances came entirely from bubble chamber experiments, where the numbers of events are small, and only in the 1980s did electronic experiments make any significant contributions.

In recent years, significant contributions have come from collider experiments. Excited Ξ baryons are produced and have been studied in the decay of the charmed Λ_c^+ into $(\Sigma^+ K^-)_{\Xi(1690)}\, K^+$ by the Belle Collaboration [1] and into $(\Xi^-\pi^+)_{\Xi^*}\, K^+$ by the BaBar Collaboration [2]. Belle measures the decay $\Xi_c^+ \to (\Xi^-\pi^+)_{\Xi^*}\, \pi^+$ [3] with unprecedented statistical quality.

Table 1. Our estimate of the status of the Ξ resonances. Only those with an overall status of *** or **** are included in the Baryon Summary Table.

Particle	J^P	Overall status	Status as seen in —				
			$\Xi\pi$	ΛK	ΣK	$\Xi(1530)\pi$	Other channels
Ξ(1318)	1/2+	****					Decays weakly
Ξ(1530)	3/2+	****	****				
Ξ(1620)		**	**				
Ξ(1690)		***	**	***	**		
Ξ(1820)	3/2−	***	**	***	**	**	
Ξ(1950)		***	**	**		*	
Ξ(2030)		***		**	***		
Ξ(2120)		*		*			
Ξ(2250)		**					3-body decays
Ξ(2370)		**					3-body decays
Ξ(2500)		*		*	*		3-body decays

****	Existence is certain, and properties are at least fairly well explored.
***	Existence ranges from very likely to certain, but further confirmation is desirable and/or quantum numbers, branching fractions, *etc.* are not well determined.
**	Evidence of existence is only fair.
*	Evidence of existence is poor.

References:

1. K. Abe *et al.* [Belle Collaboration], Phys. Lett. B **524**, 33-43 (2002).
2. B. Aubert *et al.* [BaBar Collaboration], Phys. Rev. D **78**, 034008 (2008).
3. M. Sumihama *et al.* [Belle Collaboration], Phys. Rev. Lett. **122**, 072501 (2019).