$\Gamma(\pi^+\pi^-\pi^0\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{14}/Γ_6

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID		TECN
<0.24	90	0	THALER	73	ASPK
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.7	90		ARNOLD	68	HLBC
<1.6	95		BALTAY	67B	DBC
<7.0			FLATTE	67	HBC
<0.9			PRICE	67	HBC

$\Gamma(\pi^0\mu^+\mu^-\gamma)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
<3	90	DZHELYADIN	81	SPEC	$\pi^- p \to \eta n$

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

Forbidden by P and CP invariance.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN
<0.15	0	THALER	73	ASPK

$\Gamma(3\gamma)/\Gamma(\text{neutral modes})$ $\Gamma_{17}/\Gamma_1 = \Gamma_{17}/(\Gamma_2+\Gamma_3+\Gamma_4)$

Forbidden by C invariance.

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN
<7	95	ALDE	84	GAM2

$\Gamma(\pi^0 e^+ e^-)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{18}/Γ_6

C parity forbids this to occur as a single-photon process.

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN
< 1.9	90		JANE	75	OSPK
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 42	90		BAGLIN	67	HLBC
< 16	90	0	BILLING	67	HLBC
< 77		0	FOSTER	65B	HBC
<110			PRICE	65	HBC

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$ Γ_{18}/Γ

C parity forbids this to occur as a single-photon process.

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.016	90	0	MARTYNOV	76	HLBC
<0.084	90		BAZIN	68	DBC
<0.7			RITTENBERG	65	HBC

$\Gamma(\pi^0\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{19}/Γ

C parity forbids this to occur as a single-photon process.

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<0.05	90	DZHELYADIN	81	SPEC	$\pi^- p \to \eta n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<5		WEHMANN	68	OSPK	

NOTE ON η DECAY PARAMETERS

C violation in η decays

A number of experiments have looked for charge asymmetries in $\eta \to \pi^+\pi^-\pi^0$ and $\eta \to \pi^+\pi^-\gamma$ decays. Any difference between the π^+ and π^- spectra in either decay would indicate C violation in electromagnetic interactions. Immediately following this Note, we list measurements of the following parameters:

(a) The left-right asymmetry

$$A = (N^+ - N^-)/(N^+ + N^-) \ ,$$

where N^+ is the number of events in which the π^+ energy in the η rest frame is greater than the π^- energy, *etc.*

(b) For the decay $\eta \to \pi^+\pi^-\pi^0$, the sextant asymmetry

$$A_s = \frac{N_1 + N_3 + N_5 - N_2 - N_4 - N_6}{N_1 + N_2 + N_3 + N_4 + N_5 + N_6} \ ,$$

where the N_i are the numbers of events in sextants of the Dalitz plot; see, for example, Layter *et al.* [1] A_s is sensitive to an I=0 C-violating final state.

(c) For the decay $\eta \to \pi^+\pi^-\pi^0$, the quadrant asymmetry

$$A_q = \frac{N_1 + N_3 - N_2 - N_4}{N_1 + N_2 + N_3 + N_4} \ ,$$

where the N_i are numbers of events in quadrants of the Dalitz plot. A_q is sensitive to an I=2 C-violating final state.

(d) For the decay $\eta \to \pi^+\pi^-\gamma$, evidence for a D-wave contribution to the C-violating amplitude. The upper limit for this contribution is measured by the parameter β, defined by

$$dN/d\,|\cos\theta\,| \propto \sin^2\theta\,(1 + \beta\,\cos^2\theta) \ ,$$

where θ is the angle between the π^+ and the γ in the dipion center of mass. A term proportional to $\cos^2\theta$ could also come from P- and F-wave interference.

Dalitz plot for $\eta \to \pi^+\pi^-\pi^0$

The Dalitz plot for $\eta \to \pi^+\pi^-\pi^0$ decay may be fit to the distribution

$$|\,M(x,y)\,|^2 \propto (1 + ay + by^2 + cx + dx^2 + exy) \ .$$

Here

$$x = \sqrt{3}\,(T_+ - T_-)/Q \ ,$$

$$y = (3T_0/Q) - 1 \ ,$$

where T_+, T_-, and T_0 are the kinetic energies of the π^+, π^-, and π^0 in the η rest frame, and $Q = T_+ + T_0 + T_-$. The coefficient of the term linear in x is sensitive to C violation due to an I=0 or I=2 final state. Below, we list papers that measured a, b, c, and d, but do not tabulate values of these parameters because the assumptions made by different authors are not compatible and do not allow comparison of the numerical values.

Dalitz plot for $\eta \to \pi^0\pi^0\pi^0$

The Dalitz plot for the decay $\eta \to \pi^0\pi^0\pi^0$ may be fit to

$$|\,M\,|^2 \propto 1 + 2\alpha z \ ,$$

where

$$z = \frac{2}{3}\sum_{i=1}^{3}\left(\frac{3E_i - m_\eta}{m_\eta - 3m_{\pi^0}}\right)^2 = \frac{\rho^2}{\rho^2_{\max}} \ .$$

Here E_i is the energy of the i^{th} pion in the η rest frame, and ρ is the distance from the center of the Dalitz plot. We list measurements of the parameter α below.

Reference

1. J.G. Layter *et al.*, Phys. Rev. Lett. **29**, 316 (1972).

η C-NONCONSERVING DECAY PARAMETERS

$\pi^+\pi^-\pi^0$ LEFT-RIGHT ASYMMETRY PARAMETER

Measurements with an error > 1.0×10^{-2} have been omitted.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN
0.09±0.17 OUR AVERAGE				
0.28±0.26	165k	JANE	74	OSPK
−0.05±0.22	220k	LAYTER	72	ASPK
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.5 ±0.5	37k	[5] GORMLEY	68C	ASPK

[5] The GORMLEY 68C asymmetry is probably due to unmeasured (**E** × **B**) spark chamber effects. New experiments with (**E** × **B**) controls don't observe an asymmetry.