

FIG. 2. (a) Charged-pion pair production by bremsstrahlung in  $e^+e^-$  annihilation diagrams. The radiated virtual photon can be from any of the four charged lines. (b) Charged-pion pair production involving Compton amplitude with timelike photons in  $e^+e^-$  annihilation channel.

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<sup>1</sup>S. J. Brodsky, T. Kinoshita, and H. Terazawa, Phys. Rev. Letters <u>25</u>, 972 (1970); Phys. Rev. D <u>4</u>, 1532 (1971); N. Arteaga-Romero, A. Jaccarini, and P. Kessler, Compt. Rend. <u>296</u>, 153 (1969); <u>296</u>, 1133 (1969). See also N. Arteaga-Romero, A. Jaccarini, P. Kessler, and J. Paris, Lett. Nuovo Cimento <u>4</u>, 933 (1970); Phys. Rev. D (to be published); V. E. Balakin, V. M. Budnev, and I. F. Ginsburg, Zh. Eksperim. i Teor. Fiz. Pis'ma v Redaktsiyu <u>11</u>, 559 (1970) [Soviet Phys. JETP Letters <u>11</u>, 388 (1970)]; V. M. Budnev and I. F. Ginsburg, report (unpublished).

<sup>2</sup>S. J. Brodsky *et al.* (Ref. 1) have carried out exact calculations in special cases for the purpose of comparison with the equivalent-photon method.

<sup>3</sup>S. J. Brodsky, T. Kinoshita, and H. Terazawa, Phys. Rev. Letters <u>27</u>, 280 (1971).

<sup>4</sup>T. Walsh (unpublished).

<sup>5</sup>The processes of two-real-photon annihilation into soft *n* charged-pion pairs have been considered by H. Terazawa, Phys. Rev. Letters <u>26</u>, 1207 (1971). R. Aviv, N. D. Hari Dass, and R. F. Sawyer, *ibid*. <u>26</u>, 591 (1971), and Ernest S. Abers and Stephen Fels, *ibid*. <u>26</u>, 1512 (1971) have, on the other hand, considered the annihilation of two real photons into soft  $n \pi^0$ .

<sup>6</sup>W. N. Cottingham, Ann. Phys. (N.Y.) <u>25</u>, 424 (1963).

damping when  $s_0$  is beyond the resonance region  $(\sqrt{s_0} \ge 1.5 \text{ GeV})$ . We note that all the other diagrams [Fig. 1(b) and Fig. 2(a)] are described by the pion electromagnetic form factor and produce a charged-pion pair with opposite charge conjugation from that produced in Fig. 1(a). Thus, if the charge of the individual pions is not observed, there is no interference in the cross section between the two types of amplitudes. Furthermore, since the pion pair produced by bremsstrahlung is in a *p*-wave state, these diagrams give no contribution<sup>16</sup> to (15) in the limit  $s - 4m_{\pi}^{2}$ .

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<sup>7</sup>Since it is irrelevant for the two-photon annihilation whether the incident particles are electrons or positrons, we shall call them both electrons in this paper unless specified otherwise.

<sup>8</sup>This result was also obtained by H. Terazawa in Ref. 5.

<sup>9</sup>S. Weinberg, Phys. Rev. Letters 18, 507 (1967).

<sup>10</sup>T. Das, G. S. Guralnik, V. S. Mathur, F. E. Low, and J. E. Young, Phys. Rev. Letters <u>18</u>, 759 (1967).

<sup>11</sup>K. Kawarabayashi and M. Suzuki, Phys. Rev. Letters <u>16</u>, 255 (1966); Riazuddin and Fayyazuddin, Phys. Rev. <u>147</u>, 1071 (1966).

<sup>12</sup>M. B. Halpern and G. Segrè, Phys. Rev. Letters <u>19</u>, 611 (1967); G. C. Wick and B. Zumino, Phys. Letters <u>25B</u>, 479 (1967).

<sup>13</sup>J. Schwinger, Phys. Rev. Letters <u>19</u>, 1154 (1967).

<sup>14</sup>T. D. Lee, Phys. Rev. <u>168</u>, 1714 (1968).

<sup>15</sup>T. M. Yan, Phys. Rev. <u>171</u>, 1613 (1968).

<sup>16</sup>If s is not close to  $4m_{\pi}^{2}$ , a standard calculation shows that the *p*-wave contribution in our special kinematics is proportional to the electron mass squared and therefore negligible for the  $e^{-}e^{-}$  case [cf., F. Calogero and C. Zemach, Phys. Rev. <u>120</u>, 1860 (1960). These authors claim that this contribution vanishes not merely in the relativistic limit. Their arguments seem to have neglected the spin dependence which exists when the electron mass is not zerol; it can be a significant background to (13) when  $Q^{2} \gtrsim$  for the  $e^{-}e^{+}$  case, however.

## Erratum

Theory of  $\Omega^-$  Decay, D. N. Goswami and J. Schechter [Phys. Rev. D 1, 290 (1970)]. Equation (A1) should read

$$\Gamma(\Omega - B\pi) = \frac{(E'^2 - m'^2)^{3/2}}{12\pi m(\Omega)} [A^2(E' + m') + B^2(E' - m')].$$
(A1)

Also a parenthesis is missing in Eq. (A2), which should read

$$\Gamma(\Omega - \Xi^* \pi) = \frac{(E'^2 - m'^2)^{1/2}}{4\pi m(\Omega)} \{\cdots\} .$$
 (A2)