the role of magnetic properties it would be not informative to consider the interaction of the first plate made of ferromagnetic metal with the second plate made of an ordinary (nonmagnetic) dielectric. The point is that, in accordance with Eqs. (10)–(12), magnetic properties contribute to the Casimir interaction only through the transverse electric mode at $\xi = 0$. However, the substitution of Eq. (9) into Eq. (3) leads to

$$r^{(2)}_{\mathrm{TE},d}(0, k_\perp) = 0. \tag{26}$$

As a result, the magnetic properties of a ferromagnetic metal plate interacting with a plate made of nonmagnetic dielectric do not contribute into the Lifshitz formula.

The reflection coefficients for the plate made of ferromagnetic metal (Co or Fe) at zero frequency are given by Eqs. (10)–(12) with $n = 1$ depending on the model of dielectric permittivity used. At nonzero Matsubara frequencies the reflection coefficients for this plate are given by Eq. (3) with $n = 1$ and $\mu^{(1)}_l = 1$ ($l = 1, 2, \ldots$). Equation (3) with $n = 2$ and $\mu^{(2)}_l = 1$ for all $l = 0, 1, 2, \ldots$ also determines the reflection coefficients for the plate made of an ordinary (nonmagnetic) metal. As a nonmagnetic metal we use Au with the parameters [60, 61] $\omega_{p,\mathrm{Au}} = 9.0\,\mathrm{eV}$, $\gamma_{\mathrm{Au}} = 0.035\,\mathrm{eV}$. All necessary parameters of Co are listed in Sec. III.

In Fig. 5 we present the computational results (the solid lines) for the Casimir free energy (a) and pressure (b) as functions of separation computed for the configuration of Co-Au plates by Eqs. (1) and (5) using the Drude model approach. The same notation as in Figs. 1–4 is used. However, in this case the dashed lines, computed with the magnetic properties of Co disregarded, coincide with the solid lines. The reason is that for Au described within the Drude model it holds

$$r^{(2)}_{\mathrm{TE},D}(0, k_\perp) = 0 \tag{27}$$

[compare with Eq. (11) where $\mu(0) = 1$]. As a result, similar to the case when the second plate is made of nonmagnetic dielectric, the magnetic properties of Co do not contribute to the Casimir free energy and pressure.

Another situation holds when metals are described by means of the plasma model (8). The computational results at $T = 300\,\mathrm{K}$ are shown in Fig. 6 for the Casimir free energy (a) and pressure (b). In the same way, as in Figs. 2 and 4, the dashed lines computed with the magnetic properties disregarded lie above the solid lines. However, quantitatively the role of magnetic properties is rather moderate. Thus, at separations $a = 0.5$, 2 and $6\,\mu\mathrm{m}$ $\eta^p_{\mathcal{F},\mathrm{Co-Au}} = -8.2\%$, –11%, and –5.5%, respectively, whereas $\eta^p_{P,\mathrm{Co-Au}} = -6.9\%$, –12%,