the Casimir force has begun in 1997 and has resulted in more than twenty experiments (see review [22]). Many of them were used to obtain constraints on the parameters of Yukawa-type interactions in the interaction range from a few nanometers to a few micrometers. In the torsion pendulum experiment [23] the constraints were obtained in Refs. [24, 25]; in the experiments using an atomic force microscope [26–28] the respective constraints were found in Refs. [29–31], and in the experiment with two crossed cylinders [32] in Ref. [33]. In all these experiments the Casimir force acting in normal direction to the surfaces of a sphere and a plate or two cylinders has been measured. As to the three dynamic experiments using a micromachined oscillator [34–36], the gradient of the normal Casimir force acting between a sphere and a plate was measured. In the proximity force approximation (PFA) this gradient is proportional to the Casimir pressure in the configuration of two parallel plates. Because of this, the respective constraints were obtained on the Yukawa-type pressure, rather than on the Yukawa-type force [34–36].

As is evident from the foregoing, the strongest constraints on the parameters of Yukawa-type corrections to Newtonian gravity at separations above a few micrometers are obtained from gravitational experiments. Within a wide interaction range from a few nanometers to a few micrometers, the strongest constraints follow from the measurement of the Casimir force. Notice that the first constraints on the Yukawa-type hypothetical interaction obtained from the Casimir effect [19, 24, 25, 29–31, 33, 34] were not as exact and reliable as the constraints obtained from the gravitational experiments at larger separations [13–18]. Specifically, for constraints of Casimir origin the confidence levels were not determined. This is due to some difficulties in the comparison between experiment and theory when the measured force is a strongly nonlinear function of separation. Later, however, the use of appropriate statistical methods [21, 22, 35] allowed to obtain from the Casimir effect the constraints of the same degree of reliability [35, 36] as from the gravitational experiments. In addition, the previously performed measurement of the Casimir force [28] was reanalyzed [37] and respective constraints valid at a 95% confidence level were obtained [36]. They are slightly weaker than those in Ref. [31], but benefit from high confidence. It is pertinent to note that a widely debated topic on the thermal contribution to the Casimir force [21, 22] is irrelevant to constraining the hypothetical forces of Yukawa-type from the Casimir effect because the difference between the alternative thermal corrections considered in the literature cannot be modeled by the Yukawa potential. As a result, the measurements of the Casimir force