Reply to "Comment on 'Atomic spectral line-free parameter deconvolution procedure' "

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We do not agree with the authors of the preceding Comment [X. Nikolic, X. Ojurovic, and X. Mijatovic, Phys. Rev. E, **67**, 058401, 2003]. Our numerical procedure for the deconvolution of the theoretical asymmetric convolution integral of a Gaussian and a plasma broadened spectral line profile $j_{A,R}(\lambda)$ for spectral lines enables the determination of all broadening parameters. All broadening parameters can be determined directly from the recorded line profile of a single line, with minimal assumptions or prior knowledge. Additional experimental diagnostics are not required.

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The authors of the Comment raise four points. First, they say that some factors are not included in the modeling presented in our paper, such as reabsorption, turbulence, ion dynamics, radiative transfer, and other broadening mechanisms. However this is clear from our paper [1], and the limitations of our method are well defined. We have precisely defined the necessary conditions and limiting factors for properly using our method. It has been written at many places in our paper [1]. Also, we have clearly shown the fitting model function in Sec. II, ''Theoretical Background,'' Eq. (2.9) in our paper [1]. The assumptions, which are included in realization this theoretical model function, are well known (Ref. [2] from our paper [1]). Effects such as radiative transfer, reabsorption, turbulence, ion dynamics, and other broadening mechanisms are not included in theoretical model function, and that is clearly stated in Sec. I in our paper [1].

Second, they say that even in the absence of such factors not all parameters may be accurately obtainable by the deconvolution. We do not agree with this viewpoint. We have shown it is possible in the examples we gave [1]. In cases where Stark broadening is more dominant than Doppler broadening or vice versa, determining all parameters becomes hard, because the confidence region becomes large, *but it is not impossible*. In these cases, one should estimate the confidence region for the desired accuracy of the parameters, and determine the constraints on noise. The measurements should be performed with sufficient quality so as to meet the statistical noise level requirements. The price for achieving the desired accuracy in these extreme cases is the need to meet the requirements of high quality measurements, as given in Sec. III, ''Numerical Procedure for Deconvolution,'' the last paragraph in our paper [1]. Moreover, we have discussed the limiting cases where the *K* profile becomes the clear Voigt profile, or the Voigt profile becomes the Lorentz profile, because the confidence region tends to infinity (see the ninth paragraph of Sec. II, ''Theoretical Background,'' in our paper [1]).

With respect to the third point the authors of the Comment express their opinion that in practice it is in general not trivial to determine the plasma parameters. They overlook details such as the point that the local thermodynamic equilibrium is clearly assumed in our paper (see the second paragraph of Sec. IV, ''Application of the Method,'' benchmarking, and discussion in our paper [1]). Regarding their comment on Fig. 3, this is just an example where the asymmetry of the spectral line is expressed less well and the *K* profile tends to be a Voigt one (see the ninth paragraph of Sec. II, ''Theoretical Background'' in our paper [1]).

Finally, in the fourth point the authors of the Comment raise some issues regarding the numerical procedure. They claim that we introduce an artificial weighting of the off-diagonal Jacobian elements, and so our deconvolution procedure does not guarantee the condition of positive-definiteness of the Jacobian matrix, which is needed for the stability and reproducibility of the iterative procedure. However, this is not true. We do not introduce an artificial weighting of the off-diagonal Jacobian elements, but we do introduce a dynamic weighting of the off-diagonal Jacobian elements. Our dynamic weighting parameters are in the domain of (0,1] (see Sec. III, ''Numerical Procedure For Deconvolution,'' the 11th paragraph in our paper [1], for more details). During the iterative process, if the convergence of processes becomes unstable, the parameters are automatically adjusted by decreasing toward zero. The conditions for positive-definiteness of the weighted Jacobian matrix are always met by decreasing off-diagonal dynamic weighting parameters. For sufficiently small off-diagonal weighting parameters the weighted Jacobian matrix becomes diagonally dominant and positive-definite. The algorithm dynamically decreases the weighting parameters until the condition for positive-definiteness is fulfilled. Also, when the convergence of processes is stable, they can be increased in order to accelerate the process. They are adjusted dynamically during the minimizing process. They are not fixed. In that manner, the stability of the iterative process is achieved. So, our deconvolution method meets the condition of positive-definiteness and has no problems with stability and reproducibility.

At the end of the Comment other deconvolution methods (Refs. [10–12] from the Comment) are mentioned. In our view, our method is superior because it enables the determi-

nation of all six parameters proposed by theoretical model function for an isolated atomic spectral line. The other method is limited in comparison with ours [1], because it enables a determination of four parameters only, and is not able to determine Debye shielding parameter and Doppler broadening.

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[1] V. Milosavljević and G. Poparić, Phys. Rev. E **63**, 036404 (2001).