$$f_{Ma}\left(v_{\parallel},v_{\perp}\right)=\frac{1}{\pi^{3/2}v_{T\parallel a}v_{T\perp a}^{2}}\exp\left(-\frac{\left(v_{\parallel}-V_{Da}\right)^{2}}{v_{T\parallel a}^{2}}-\frac{v_{\perp}^{2}}{v_{T\perp a}^{2}}\right)$$
$$v_{T\parallel a}^{2}=\frac{2T_{\parallel a}}{m_{a}},\quad v_{T\perp a}^{2}=\frac{2T_{\perp a}}{m_{a}}$$

$$v_{A}^{2}=\frac{B^{2}}{4\pi n_{i}m_{i}}$$
$$\beta_{\parallel a}=\frac{8\pi n_{a}T_{\parallel a}}{B^{2}},\quad \beta_{\perp a}=\frac{8\pi n_{a}T_{\perp a}}{B^{2}}$$

$$v_{\parallel}=v_{A}u_{\parallel},\quad v_{\perp}=v_{A}u_{\perp},\quad U_{Da}=\frac{V_{Da}}{v_{A}}$$
$$\mu_{a}=\frac{m_{i}}{m_{a}},\quad \tilde{q}_{a}=\frac{q_{a}}{q_{i}},\qquad \tilde{n}_{a}=\frac{n_{a}}{n_{i}}$$
$$f_{Ma}\left(u_{\parallel},u_{\perp}\right)=\frac{1}{\pi^{3/2}v_{T\parallel a}v_{T\perp a}^{2}}\exp\left(-\frac{v_{A}^{2}\left(u_{\parallel}-U_{Da}\right)^{2}}{v_{T\parallel a}^{2}}-\frac{v_{A}^{2}u_{\perp}^{2}}{v_{T\perp a}^{2}}\right)$$
$$\frac{v_{T\parallel a}^{2}}{v_{A}^{2}}=\frac{m_{i}}{m_{a}}\frac{n_{i}}{n_{a}}\frac{8\pi n_{a}T_{\parallel a}}{B^{2}}=\frac{m_{i}}{m_{a}}\frac{n_{i}}{n_{a}}\beta_{\parallel a}=\frac{\mu_{a}}{\tilde{n}_{a}}\beta_{\parallel a},\qquad v_{T\parallel a}=v_{A}\sqrt{\frac{\mu_{a}}{\tilde{n}_{a}}}\sqrt{\beta_{\parallel a}}$$
$$\frac{v_{T\perp a}^{2}}{v_{A}^{2}}=\frac{m_{i}}{m_{a}}\frac{n_{i}}{n_{a}}\frac{8\pi n_{a}T_{\perp a}}{B^{2}}=\frac{m_{i}}{m_{a}}\frac{n_{i}}{n_{a}}\beta_{\perp a}=\frac{\mu_{a}}{\tilde{n}_{a}}\beta_{\perp a},\qquad v_{T\perp a}^{2}=v_{A}^{2}\frac{\mu_{a}}{\tilde{n}_{a}}\beta_{\perp a}$$
$$\begin{aligned}f_{Ma}\left(u_{\parallel},u_{\perp}\right)&=\frac{1}{\pi^{3/2}v_{T\parallel a}v_{T\perp a}^{2}}\exp\left(-\frac{\left(u_{\parallel}-U_{Da}\right)^{2}}{\frac{\mu_{a}}{\tilde{n}_{a}}\beta_{\parallel a}}-\frac{u_{\perp}^{2}}{\frac{\mu_{a}}{\tilde{n}_{a}}\beta_{\perp a}}\right)\\&=\frac{1}{\pi^{3/2}v_{T\parallel a}v_{T\perp a}^{2}}\exp\left(-\tilde{n}_{a}\frac{\left(u_{\parallel}-U_{Da}\right)^{2}}{\mu_{a}\beta_{\parallel a}}-\frac{\tilde{n}_{a}u_{\perp}^{2}}{\mu_{a}\beta_{\perp a}}\right)\\&=\frac{1}{v_{A}^{3}}\frac{\tilde{n}_{a}^{3/2}}{\pi^{3/2}\mu_{a}^{3/2}\sqrt{\beta_{\parallel a}}\beta_{\perp a}}\exp\left(-\tilde{n}_{a}\frac{\left(u_{\parallel}-U_{Da}\right)^{2}}{\mu_{a}\beta_{\parallel a}}-\frac{\tilde{n}_{a}u_{\perp}^{2}}{\mu_{a}\beta_{\perp a}}\right)\end{aligned}$$

$$\int d^{3}v\, f_{Ma}\left(v_{\parallel},v_{\perp}\right)=1\Longrightarrow\int d^{3}u\, v_{A}^{3}f_{Ma}\left(u_{\parallel},u_{\perp}\right)=1$$

$$\tilde{f}_{Ma}\left(u_{\parallel},u_{\perp}\right)=v_{A}^{3}f_{Ma}\left(u_{\parallel},u_{\perp}\right)\Longrightarrow\boxed{\tilde{f}_{Ma}\left(u_{\parallel},u_{\perp}\right)=\frac{\tilde{n}_{a}^{3/2}}{\pi^{3/2}\mu_{a}^{3/2}\sqrt{\beta_{\parallel a}}\beta_{\perp a}}\exp\left(-\tilde{n}_{a}\frac{\left(u_{\parallel}-U_{Da}\right)^{2}}{\mu_{a}\beta_{\parallel a}}-\frac{\tilde{n}_{a}u_{\perp}^{2}}{\mu_{a}\beta_{\perp a}}\right)}$$

Kappa:

$$f_{\kappa a}\left(v_{\parallel},v_{\perp}\right)=\frac{1}{\pi^{3/2}\kappa_{a}^{3/2}\theta_{\parallel a}\theta_{\perp a}^{2}}\frac{\Gamma\left(\kappa_{a}+1\right)}{\Gamma\left(\kappa_{a}-1/2\right)}\left(1+\frac{\left(v_{\parallel}-V_{Da}\right)^{2}}{\kappa_{a}\theta_{\parallel a}^{2}}+\frac{v_{\perp}^{2}}{\kappa_{a}\theta_{\perp a}^{2}}\right)^{-(\kappa_{a}+1)}$$
$$\theta_{\parallel a}^{2}=\left(1-\frac{3}{2\kappa_{a}}\right)v_{T\parallel a}^{2}\quad\theta_{\perp a}^{2}=\left(1-\frac{3}{2\kappa_{a}}\right)v_{T\perp a}^{2}$$

$$\theta_{\parallel a}^{2}=v_{A}^{2}\tilde{\theta}_{\parallel a}^{2}\quad\theta_{\perp a}^{2}=v_{A}^{2}\tilde{\theta}_{\perp a}^{2}$$
$$\tilde{\theta}_{\parallel a}^{2}=\left(1-\frac{3}{2\kappa_{a}}\right)\frac{\mu_{a}}{\tilde{n}_{a}}\beta_{\parallel a}\quad\tilde{\theta}_{\perp a}^{2}=\left(1-\frac{3}{2\kappa_{a}}\right)\frac{\mu_{a}}{\tilde{n}_{a}}\beta_{\perp a}$$
$$f_{\kappa a}\left(u_{\parallel},u_{\perp}\right)=\frac{1}{v_{A}^{3}\pi^{3/2}\kappa_{a}^{3/2}\tilde{\theta}_{\parallel a}\tilde{\theta}_{\perp a}^{2}}\frac{\Gamma\left(\kappa_{a}+1\right)}{\Gamma\left(\kappa_{a}-1/2\right)}\left(1+\frac{\left(u_{\parallel}-U_{Da}\right)^{2}}{\kappa_{a}\tilde{\theta}_{\parallel a}^{2}}+\frac{u_{\perp}^{2}}{\kappa_{a}\tilde{\theta}_{\perp a}^{2}}\right)^{-(\kappa_{a}+1)}$$
$$\tilde{f}_{\kappa a}\left(u_{\parallel},u_{\perp}\right)=v_{A}^{3}f_{\kappa a}\left(u_{\parallel},u_{\perp}\right)$$
$$\boxed{\tilde{f}_{\kappa a}\left(u_{\parallel},u_{\perp}\right)=\frac{1}{\pi^{3/2}\kappa_{a}^{3/2}\tilde{\theta}_{\parallel a}\tilde{\theta}_{\perp a}^{2}}\frac{\Gamma\left(\kappa_{a}+1\right)}{\Gamma\left(\kappa_{a}-1/2\right)}\left(1+\frac{\left(u_{\parallel}-U_{Da}\right)^{2}}{\kappa_{a}\tilde{\theta}_{\parallel a}^{2}}+\frac{u_{\perp}^{2}}{\kappa_{a}\tilde{\theta}_{\perp a}^{2}}\right)^{-(\kappa_{a}+1)}}$$